The Chemical Age

VOL LXVI 8 MARCH 1952 No. 1704

TECHNOLOGY DEPT.

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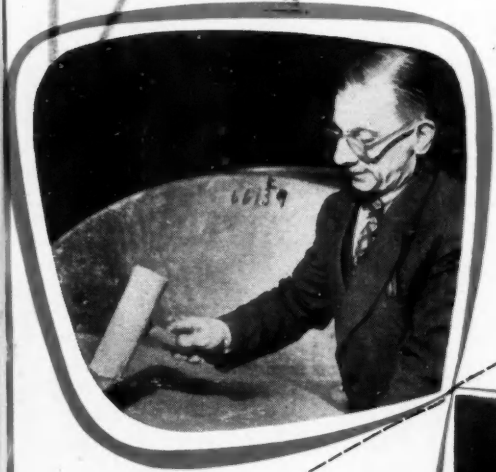

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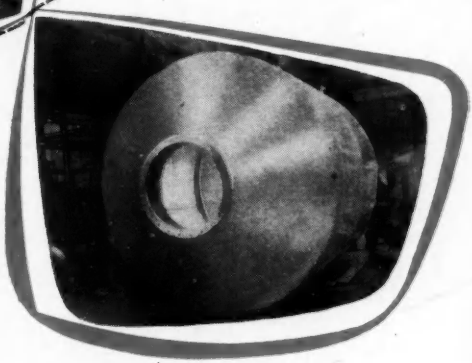

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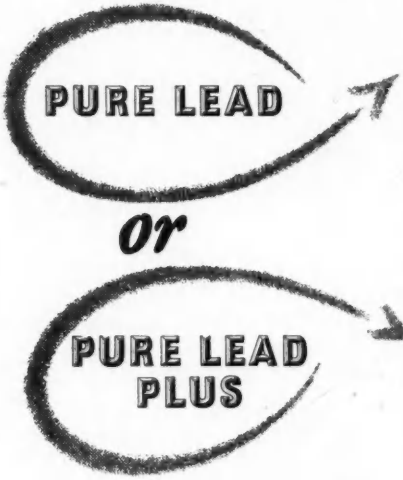

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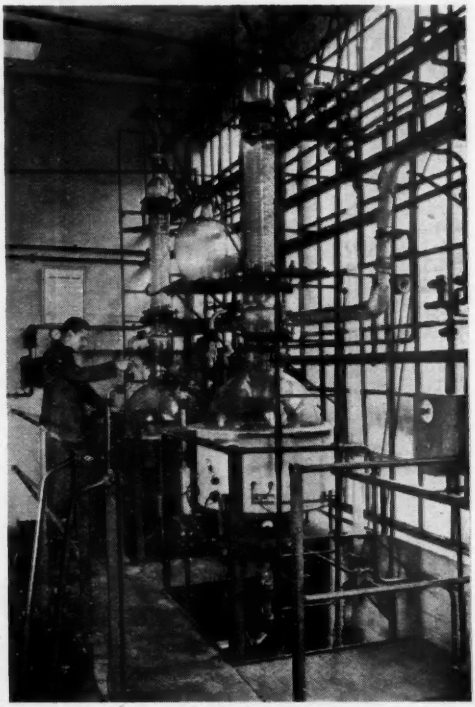

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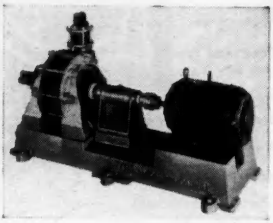

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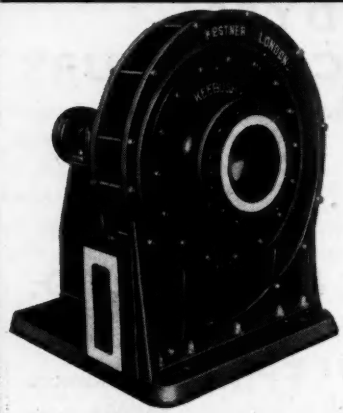

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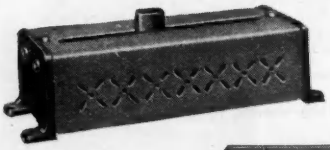

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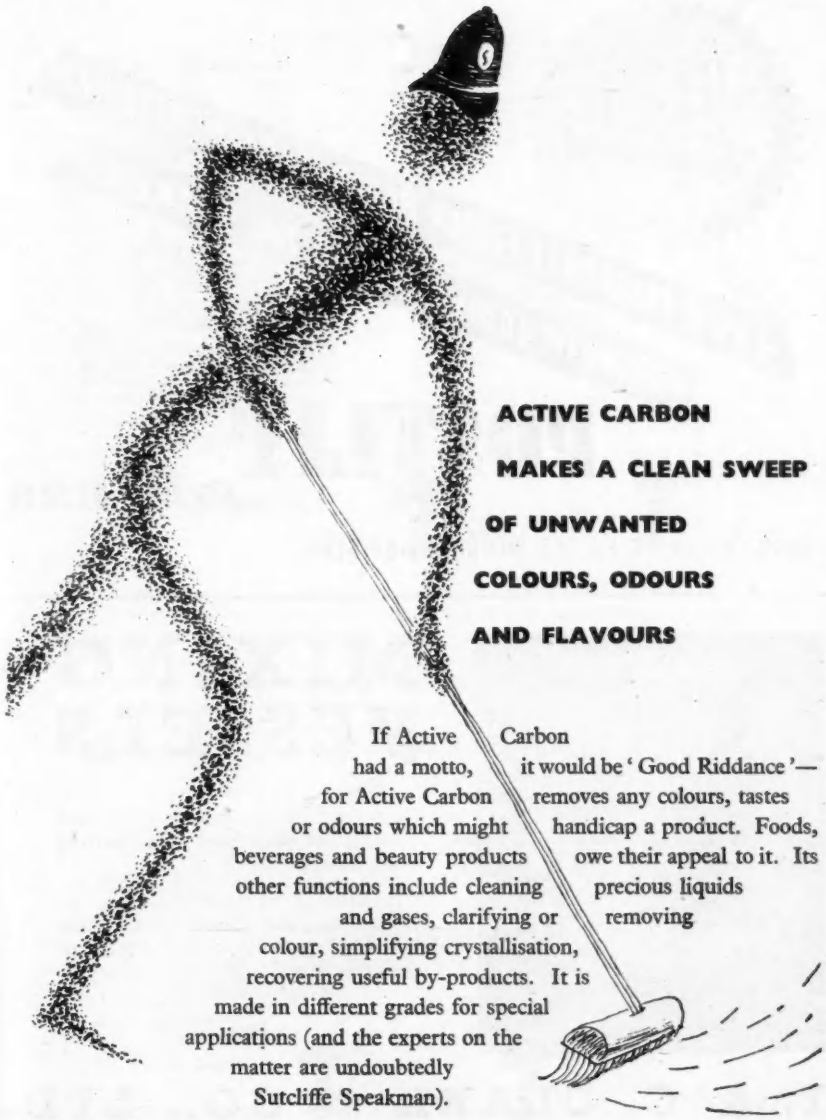

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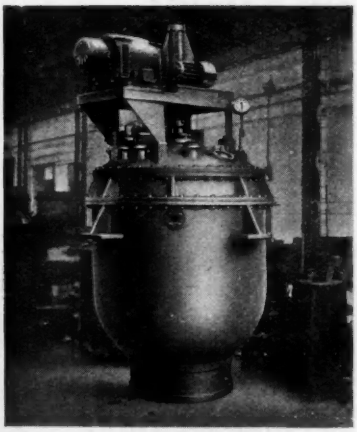

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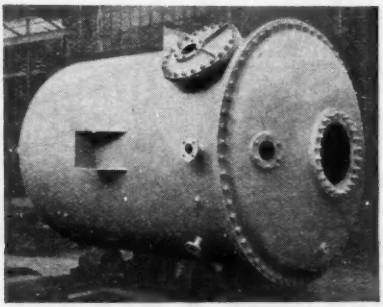

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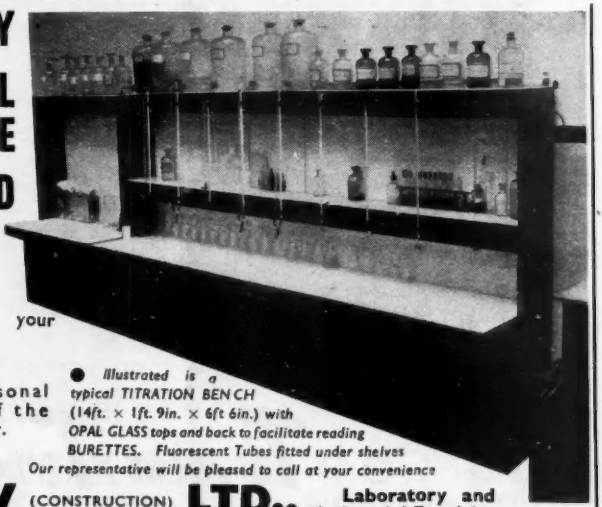

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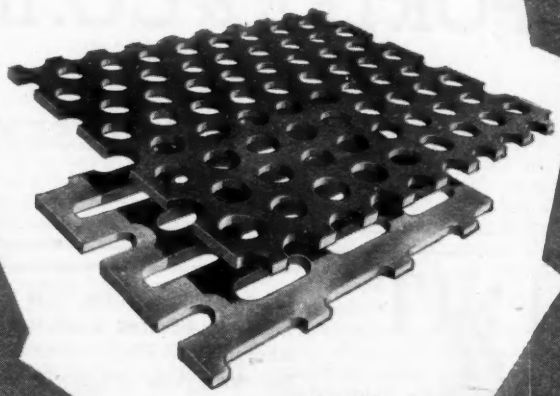

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Volume LXVI **8 March 1952** **Number 1704**

Public Relations

AT a time when official information services are being severely curtailed as a measure of national economy there is some danger that their purposes will be generally looked upon as dispensably luxurious. To some there may still be an element of deceit in the idea of cultivating good public relations by words as distinct from products and prices but this is an unreal, out-of-date viewpoint. The technical nature of the chemical industry together with its traditional reticence have made it an outstanding example of public inappreciation and misunderstanding. If anyone doubts whether this matters, let him read William Rand's address to the American section of the Society of Chemical Industry, delivered some time ago but published only recently here (*Chemistry & Industry*, 1952, **2**, 22-24). Mr. Rand's concern was limited to the dangers that are inherent in public ignorance about the American chemical industry, but the points he made apply with no less force on this side of the Atlantic. The responsibility for better public understanding lies not with the public but with chemists and the chemical industry.

'When a ship sinks, when an airplane crashes, or a railroad train is wrecked, the public does not blame the shipping industry, aviation, or the railroad. Their first thoughts are that there may have been human carelessness or that some act of God caused the disaster. When there is a chemical accident the material is to blame in the public mind.' Few can deny the truth of this. Indeed, where certain classes of chemicals are concerned, some energetically vocal sections of the public are eager to blame unknown and future disasters upon them! The word 'chemical' can always whip up a witch-hunt with the more gullible. Despite all that the chemical industry has done to improve the lot of man in the past hundred years, 'chemical' as a noun or adjective is still not free from suspicion and stigma. It might be supposed that with the general spread of education the vast majority of the public would become reasonably chemical-minded as a result of learning some chemistry at school. Steady progress in this direction was undoubtedly taking place until 1939 but it must be regarded as highly doubtful whether the same rate of progress has continued since. The supply of teachers qualified to teach chemistry is gravely inadequate; far better prospects are offered to chemists if they practice their profession rather than show others how to. Innumerable schools lack space for laboratory facilities. We may be able to assume

today that the layman of forty or over possesses a little lingering knowledge of chemistry; in the 'sixties and after we shall not be able to make that assumption with the same confidence. Nevertheless, on many other subjects the public is increasingly better informed, particularly on subjects that stimulate a critical outlook.

Products of the chemical industry play an ever-expanding part in everyday life. All too often they must play an intermediate and hidden part, taken for granted by the final consumer or user. In many cases an entirely chemical product is not regarded as 'chemical' at all because it has become so familiar an article of living, e.g., artificial fibres. The size and diversity of the chemical industry, the contributions it has made in the post-war years towards dollar-savings and dollar-earnings, its money-output value per man-hour, these are not facts that are generally known. But let it be rumoured in an urban area that one of the new factories will be a chemical factory and at once there is a campaign of opposition with intense and exaggerated fears of evil odours, pollution, and danger. Let there be a serious accident through the misuse of a chemical and there is all too quickly an avalanche of adverse publicity that may well reduce the safe and correct usage of the product.

Neither the industry nor chemists themselves have done enough to inform the public about their products and their work. Far too little effort is made to present the facts in ordinary terms. How chemical products are made, how they have been developed before reaching the stage of commercial production, how many important uses they have, whether or not the public ever uses them directly, how much is totally produced for use at home and for sale abroad, all these are facts to be told and telling them will inevitably stimulate good public relations. The general standard of technical publicity in the chemical industry has improved enormously in the past twenty years; good inter-industry information literature and services are no longer exceptional. But public opinion about chemicals and the industry that produces them has been left dangerously in a vacuum. To quote Mr. Rand: '. . . we, the trustees of this industry, have done very little towards telling our story to the public. In comparison with the oil industry, the steel industry, or the railroads, our efforts are infinitesimal . . .' Or, to quote H. W. Cremer, president of the RIC, 'I have no doubt whatever that a major contributing factor to the success of many of those chemists who have attained high positions . . . has been their ability to talk and to write clearly and cogently, and, above all, to make themselves understood. I feel this point cannot be overstressed . . .' (*Journal*, RIC, 1952, **76**, 2.)

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Notes & Comments

Are we Too Frivolous?

THE comprehensive nature of the programmes for the annual meetings of American and European technical and scientific societies has attracted our attention recently and reluctantly we have been forced to admit that our overseas colleagues appear more serious-minded than we are. In spite of the fact that the distances which have to be covered are much greater abroad, attendances are infinitely better. While the social side is not neglected, our American, Canadian and Continental counterparts seem more interested in exchanging views on their science or technology than we are. The programmes appear more topical and the papers read more practical. The subjects are not confined to one particular subject but have obviously been chosen to interest and help each and every member. Furthermore, as is usually the case in countries outside the United Kingdom, special attention is paid to the student and junior member. We are told that too many technical papers would frighten people away from British conventions but we refuse to believe it. Perhaps if programme committees were to emphasise the educational rather than the social side and make concessions to junior members of the profession the attendances might be better. More firms could be encouraged to pay their employees' expenses in this way. 'All work and no play' may not be wise but this country is now in a very serious position and we cannot afford to waste our opportunities.

Birth Pangs to Come

LET it not be supposed that Monsanto's latest soil 'improver'—Krilium (see CHEMICAL AGE, *56* 169)—will be born without a struggle. It will not be universally acclaimed, even after test, as the miracle of the age, nor will the chemists who invented it be the object of unsullied admiration. No new product, especially one concerning Nature's principal domain—the earth—is allowed to get by without brisk opposition, and this is as it should be, if only to prevent the chemists from overreaching themselves. However, just as there are fanatical advocates of the use of chemicals, so also are there fanatical enemies of it. A foretaste of what Krilium may expect in this direction is given in a short letter which appeared in *Chemical Week* recently. In this an agricultural chemist suggests that the new 'improver' will contribute to an even more rapid rate of soil depletion and human decline, and suggests that the only solution is to use natural methods and return everything to the soil instead of the waterways.

Not Back to Nature

WHETHER or not this will turn out to be true remains to be seen, although it seems likely that Krilium will probably be capable of more good than harm. What is more to the point is that the various gentlemen who say such things never wait to find out, thereby immeasurably weakening their case. To be consistent in urging the abandonment of all aids to Nature demands the complete removal of one's clothes and putting the clock back hundreds, if not thousands of years. The fact is that the fabric of life nowadays has grown so complicated, whether we like it or not, that natural methods are simply not enough. Nature's remedies are drastic, if effective, and if we largely destroy one of her staple methods of killing off surplus population—disease—we must expect a large increase in her use of the other—famine—unless we attempt to arrest it. This is not, of course, to encourage the wholesale use of untried substances, or to deny their value to the unscrupulous. It is merely to accept the place of man-made substances in the general scheme of things, and to emphasise that because something is made by man's ingenuity, it is not necessarily a diabolical instrument of self-destruction. Cortisone is preferable to cholera, even if it does have unpleasant side-reactions, and Krilium could not possibly make worse the periodic famines that sweep across India.

To Study U.S. Methods

Heavy Chemicals Productivity Team

REPRESENTATIVES of the British heavy chemicals industry sailed for the United States on 6 March to study over a period of six weeks the level of productivity attained in the equivalent American industry. The visit is undertaken under the auspices of the Anglo-American Council on Productivity and the technical aid programme of the Mutual Security Agency (formerly Economic Co-operation Administration) which meets the dollar costs involved.

The team is under the leadership of Mr. J. Grange Moore, M.A., and the secretary is Mr. D. E. Ladhams, B.Sc., F.R.I.C.

Points to be Studied

Consideration will be given to: Definition and measurement of productivity; factory and plant layout; constructional materials for plant; instrumentation and automatic control; mechanical handling of materials; treatment and disposal of effluents; standardisation of equipment and products; organisation of plant maintenance; supervision and cost control; labour recruitment, training, promotion, shift-working, incentives and the like; safety and welfare.

Visits will be paid to manufacturing plants, mainly in the Southern States, including the American Cyanamid and Chemical Corporation, Stamford, Connecticut; Monsanto Chemical Company, St. Louis, Missouri (Organised Phosphate Division); Commercial Solvents, Sterlington, Louisiana; Celanese Corporation of America, Chemcol, Texas; Shell Chemical Company, Houston, Texas; Dow Chemical Company, Freeport, Texas; and Diamond Alkali Company, Houston, Texas.

The team has been invited to attend the Convention of the American Institute of Chemical Engineers at Atlanta, Georgia, on 16-19 March.

A report embodying findings and recommendations considered applicable in the interests of efficiency and productivity in Britain will in due course be published in the series issued by the Anglo-American Council on Productivity.

The team will include the following: J. Grange Moore, B.A., M.A., deputy works manager, General Chemicals Division, I.C.I., Ltd.; E. F. Brookman, B.Sc.(Lon.), Ph.D. (Cantab.), general works manager, I Division, I.C.I., Ltd.; G. F. Clayton, per nel manager, Hardman and Holden, A. J. Gait, B.Sc., M.Sc., operation planning specialist, Petrochemicals, Ltd.; G. H. Maddra, B.Sc., A.R.C.S., head of Technical Development Department, Peter Spence and Sons Ltd.; J. G. Sommerville, plant manager, British Titan Products Co., Ltd.; S. M. Warr, works manager, Peter Spence and Sons, Ltd.; E. V. Weekes, M.Sc.(Lond.), area manager (Production), Monsanto Chemicals, Ltd.; A. H. Wells, production and factory director, A. Boake Roberts and Co., Ltd.; R. J. Amer, leading hand, Brotherton and Co., Ltd.; J. A. Crooks, process worker, British Titan Products Co., Ltd.; E. H. Hazeldine, chief operator, Petrochemicals, Ltd.; G. Leather, boilermaker, I.C.I., Ltd.; J. C. S. Malloch, chargehand, Hardman and Holden, Ltd.; J. Walker, stillman, Hull Distillery Co., Ltd.; and M. Scott, general worker, Billingham Division, I.C.I., Ltd. Team secretary: D. E. Ladhams, B.Sc.(Lond.), F.R.I.C., works manager, Distillers Co., Ltd.

Indian Jute Research

ON 2 January of this year, Mr. Nehru, Prime Minister of India, opened the new laboratory of the Indian Jute Mills Association Research Institute at Taratola, near Calcutta. The jute industry is of course one of India's major industries, and has always been in the forefront in the application of scientific research to its many problems. The research station was first conceived in 1932, and present-day conditions, with the entry into traditional overseas markets of powerful competitiors and substitutes, emphasise the need for long-term planning and research in the jute industry.

The initial construction on the Research Institute's new laboratories, reported by *Indian Trade and Industry*, began in earnest immediately after the war. In addition to administration and other office accommodation, a library, display room, lecture room, and studio have been installed. Seventeen laboratories are fitted with modern equipment, and are divided into sections covering analytical chemistry, physics, microbiology, biochemistry, X-ray, textile testing and textile technology. In addition, a technical service section is maintained, staffed by four technical liaison officers.

Management & Accident Prevention

Sir Ewart Smith Addresses Conference

THE interest shown and the desire to reduce industrial accidents to a minimum was proved by the large gathering of 450 who attended the London Groups Joint Accident Prevention Conference on Monday, 25 February.

In his address on 'Management and Accident Prevention,' Sir Ewart Smith, Technical Director of Imperial Chemical Industries, Ltd., said that he was deeply interested in the whole problem of management, including accident prevention, and as he was addressing experts in this field he would keep his talk on a general basis. He was particularly glad that the title should include the term management because he believed that management of all kinds was really the key to accident prevention, just as he believed that it was the key to well-being and economy as a whole. What was the place of accident prevention in industrial life? he asked. He had often been tempted to say that it was a negative thing, and because it was negative it was automatically made more difficult to the ordinary man and woman. People responded best to positive ideas and positive action. There was a tendency to specialise it and segregate it out to a special aspect of industrial life. He believed that the line of attack should be to treat accident prevention as just one facet of the industrial life and incorporate it with all the other aspects of management and industry to obtain a definite and positive approach.

General Efficiency

Referring to various aspects touching accident prevention he said that there was firstly the question of general efficiency and good running of an organisation. Factories, buildings and roads should be kept in such a condition that any man or woman could take a real pride and responsibility in them.

Properly treated, accident prevention in an organisation could form a most valuable and useful link between all members of a business. There was, therefore, in this subject the opportunity for the positive approach which gave management the opportunity of really impressing on everyone in the organisation that it was a unity of purpose and everyone was responsible for achieving that purpose. He thought that we were sometimes apt to forget that good management involved, or should involve, a clear statement of policy from the top and execution of that policy down the managerial ladder to the man in the ranks.

Everybody's Responsibility

Inasmuch as direct or line management had the direct responsibility of production, it was particularly important that in the matter of accident prevention everyone should know his own function and responsibility. He believed that line management, works management and staff should have the direct and ultimate responsibility for preventing accidents. They should not say that because they had a specialised safety officer attached to the works that it was his responsibility. Specialised safety officers were there to give good advice and to see that people at all levels did the right thing but he contended that the direct responsibility for accident prevention rested on line management. That responsibility included making use of the specialised officers which were now normally provided. He did not imply, however, that the specialised safety services were of little importance—they equally had a major part to play.

Speaking on the comparison of results he said that it was unfair to compare one accident rate with another as conditions were so different. But if it was recognised that each factory was faced with its own special conditions, then a progressive approach could be made to the business. Therefore, in dealing with these accident prevention matters the thing he looked for in his own organisation was the rate of improvement of each section relative to its previous best record. In this way everybody was set a target within his own capabilities. Giving the example of two organisations, with more or less the same difficulties, he said that in 1946 the accident rate of the one was 14 and in 1951 this was reduced to 4. The other organisation's accident rate in 1946 was 2 and in 1951 0.6. Both made exactly the same rate

of progress reckoned as a percentage from their starting point.

While on the question of comparisons he said that there was a large fatality list which was the most distressing form of accidents. Little could be done directly or specifically to reduce fatalities except by attacking the accident rate.

Were we going to tackle the problem of accident prevention by Government regulation or by education and leadership? he asked. The answer quite clearly was by both, but that only went a part of the way, and the fact that accident rates varied so much left clear indications that regulations and control did not give the whole answer. One of the striking features that came out of the various U.S. productivity team reports in the last two years was the high safety consciousness and high safety records in the U.S.A., in spite of the fact that their factory regulations were very much less complete and much laxer than ours. It was, he said, quite striking here as in the States that as productivity went up the rate of accidents went down. Accidents were not prevented by people going slowly but in all probability this increased as people grew more careless and thoughtless.

In conclusion, he said, that the business of accident prevention was tremendously worthwhile, if it was not taken as a separate thing but as one aspect of industrial work which they were all trying to aim at making more interesting. They could not, however, expect an improvement unless the management at the top displayed clarity of thought and purpose, the will and leadership which alone could make it possible.

The chairman during the morning session was Major-General B. K. Young, Director-General of the Royal Society for the Prevention of Accidents. Other speakers during the conference were Mr. J. C. Corrin on 'Accident Prevention in Relation to Common Law Claims', Dr. K. Biden-Steele on 'Some Medical Aspects of Accident Prevention', and Mr. J. O'Dowd on the 'Trade Unionist and Accident Prevention'.

A Year of Expansion

Mathieson Chemical Corporation's Report

EXTENSIVE development and expansion during the year ended 31 December, 1951, were announced by Thomas S. Nichols, president of the Mathieson Chemical Corporation, Baltimore, U.S.A., in its annual report recently released.

In October, 1951, the company acquired 137,225 shares or approximately 26 per cent of the outstanding stock of the American Potash and Chemical Corporation, which had a plant at Trona, California, and produced potash salts, boron products, soda ash, salt cake, lithium salts and bromine.

A new corporation, Mathieson Alabama Chemical Corporation, was formed to construct a plant at McIntosh (near Mobile), Alabama, for the production of chlorine and caustic soda. This plant was expected to be in production about the beginning of June this year.

Acquisition of Mathieson Hydrocarbon Chemical Corporation, a major step in the company's development, provided a basic position for entry into the rapidly expanding organic chemicals industry.

In December, 1951, the company acquired a five-year lease (with option of renewal for 15 years) of the Morgantown Ordnance Works. This plant, one of the largest in the country, was capable of producing over 200,000 tons of ammonia and/or methanol a year.

The modern electrolytic chlorine plant completed at Saltville, Va., in November, 1951, was built to supply the organic chemical plant at Doe Run, Ky. It was now in full production with a rated capacity of over 200 tons a day of chlorine and rayon grade caustic soda.

Further expansion at the McKamie, Arkansas, sulphur recovery plant had made it possible for the company to supply up to 17 per cent of its total sulphur requirements by the recovery of sulphur from sour natural gases.

The fertiliser plant at Houston, Texas, was further developed for the manufacture of additional grades of high-analysis pelletised fertilisers. Some of the shortage of nitrogenous fertilisers was alleviated by increased output of the Lake Charles anhydrous ammonia plant extended in 1951.

Three insecticide mixing plants were completed at Little Rock, Ark.; Williamston, N.C.; and Houston, Texas.

Sales and net earnings reached new high levels during the year. The value of sales was $91,234,076, compared with $75,775,757 for 1950, an increase of 20.4 per cent. Net earnings, after providing for taxes, were up 7.3 per cent and amounted to $9,652,993.

High-Pressure Hydrogenation

Some Modern Trends in the Up-Grading of Heavy Oils

HIGH-PRESSURE hydrogenation has been practised for over two decades in the production of synthetic liquid fuels from coals and coal tars. Economically, this use of the process is at present of little interest to oil-rich countries. However, the development of the process has brought with it possibilities of increasing the versatility and profit margin of petroleum refineries by the hydrogenation of heavy residual oils.

The attraction of high-pressure hydrogenation in refinery operations is dictated by local market conditions. It permits the almost quantitative conversion of heavy fuel oils and gas oil to petrol and L.P. gases. It thus becomes of primary interest to refineries located in areas where there is a substantial difference in price between petrol and heavier stocks.

Economic factors which may contribute to such a situation include the existence of only a limited industrial market for fuel oils (such as is found in the Mid-Western States of the United States) or the need for long transport hauls from the refinery to the principal markets (as in Alberta province or in the Middle East). In the latter case, the lower-priced fuel oils will not be able to bear the substantial freight charges which can be absorbed more readily by gasoline products.

Hydrogenation to-day covers a whole gamut of processes. At the mildest extreme is hydroforming in its various forms. This process is perhaps more closely related to catalytic cracking than to high-pressure hydrogenation. Operation is at 100-300 p.s.i. in the presence of a catalyst (molybdic acid on alumina, platinum, etc.). Here, the feedstock must be substantially in the petrol range. The process consists largely of aromatisation and isomerisation of the original hydrocarbons, with an applied hydrogen atmosphere to minimise coke formation. Unless a highly olefinic charging stock is employed, the process is actually a hydrogen producer rather than consumer.

Up-Grading Heavy Oils

To be of interest in up-grading heavy oils, substantially higher operating pressures are required. Processing at pressures around 750 p.s.i. may be feasible. However, to hydrogenate refractory oils, operating pressures may have to be as high as 10,000 p.s.i. For the majority of oils handled in refineries, operating pressures not higher than 4,500 p.s.i. are adequate.

Hydrogen Balance

The underlying problem in up-grading heavy fuel oils is a restoration of the hydrogen balance. All thermal processes applied to petroleum fractions tend to disproportionate the hydrogen/carbon ratio in a manner which enriches the lighter oils with regard to their hydrogen content, by depleting the residual oils. This applies to topping and, to a much more pronounced extent, to thermal and catalytic cracking, as well as all derivative processes such as visbreaking, delayed coking, etc. Illustrative is the case of a topping residue analysing between 12 and 13 per cent hydrogen. In the course of thermal cracking, the stock was converted on the following fractions:

Hydrogen-enriched — Cracked gasoline (containing 14.2 per cent H), cracked gas oil (containing 13.3 per cent H), cracking gas (containing 16.7 per cent H).

Hydrogen-depleted—Fuel oil (containing 9.0 per cent H), Coke (containing 7 to 8 per cent H).

The residual oils are of such low hydrogen content and of so viscous a consistency that they are no longer suitable as raw materials for further cracking—for both chemical and mechanical reasons.

To reconstitute these oils into a suitable raw material for petrol production by any of the available cracking or splitting processes, they must therefore be rehydrogenated.

Two types of process are available to this end. Hydrogenation in the liquid phase, and hydrogenation in the vapour phase. The former, operating in the presence of a small amount of expendable catalyst (such as $FeSO_4$, tin salts, etc.) employs a feedstock of heavy oils. The charge is diluted with a recycle oil to a suitable consistency, and is then passed through a series of high-pressure converters where a combination of cracking and hydrogenation reactions are

carried out in the presence of high-pressure hydrogen.

The product petrol formed in the liquid phase of the process is of relatively low quality. At the same time, this type of operation is not highly selective, and a high ratio of gas to petrol is produced. Liquid-phase hydrogenation is not, therefore, suitable for the production of petrol. The process is, rather, to be integrated with other refinery operations.

Liquid-Phase Hydrogenation

An ideal approach is to produce predominantly gas oil and heavier stocks by liquid-phase hydrogenation. The gas oil is topped off and used as feedstock to a catalytic cracker for the production of high-grade petrol. By-product cracking gas oil is further subjected to thermal cracking. The heavy fuel oils derived from both cracking operations are recycled to the hydrogenation process for conversion to a highly saturated catalytic cracker feedstock.

In the course of liquid-phase hydrogenation, a substantial portion of the sulphur, oxygen, and nitrogen are removed from the feedstock. The problem of product refining is thus greatly eased. The refining action of vapour-phase hydrogenation is even more pronounced, being almost quantitative.

Vapour-phase hydrogenation offers important alternative operating schemes. Investment in plants of this type is lower than in liquid-phase hydrogenation units. However, schemes which can be devised for the integration of vapour-phase hydrogenation into refinery operations must necessarily show a lower overall yield than is possible with liquid-phase hydrogenation. The reason rests in the inability of vapour-phase hydrogenation to use feedstocks boiling substantially above the gas oil range (maximum permissible end point for vapour-phase feedstocks is 700°F.).

Vapour-phase hydrogenation is carried out in the presence of a fixed-bed catalyst at pressures which also range over the whole scale up to 10,000 p.s.i., but preferably around 3-4,500 p.s.i. for the purposes of the petroleum industry. A variety of catalysts are available, all of which are immune to the action of sulphur, which is a virulent poison for most other hydrogenation catalysts. The bulk of industrial experience has been acquired with tungsten sulphide catalysts, although zinc-chromia and iron-based catalysts have also achieved commercial significance.

Two types of tungsten sulphide catalysts fit into the operating scheme of large petroleum refineries. These are pure WS_2, which has a strongly hydrogenating action, but yields a product of relatively low octane number, and WS_2 on a Fuller's earth carrier, which will yield a high-grade product but is dependent on a feedstock of relatively high hydrogen content and low oxygen and nitrogen analysis.

Illustrative of the substantial increase in yield which is possible by vapour-phase hydrogenation over catalytic cracking is the following comparison in yields employing the same middle oil—due to G. Free.

	Hydrogenation	*Cat. Cracking*
Wt. % Petrol	90	45
Wt. % Gas	10	12
Wt. % Coke	0	3
Wt. % Residual Middle Oil	0	40

It should be noted that these figures represent overall yields rather than once-through conversion (in the case of hydrogenation). The point is, of course, that the residual middle oil obtained in the hydrogenation can be recycled until it is completely converted, while the residual middle oil formed in the cracking process is so depleted in hydrogen content that it is no longer a suitable charging stock for subsequent catalytic cracking. In standard practice, this gas oil may be sold either as it is, or it may be subjected to thermal cracking for disproportionation into petrol (of lower quality than can be obtained in catalytic cracking) and a heavy fuel oil.

Combination Process Possible

A combination process between vapour-phase hydrogenation and catalytic cracking is becoming possible, which will be characterised by high yields almost approaching those of total hydrogenation, while modifying substantially the high investment costs required by a completely pressurised operation. In this processing scheme, cracking middle oil is cycled to hydrogenation over high-WS_2 catalyst. Since the petrol formed in this phase is of inferior quality to the catalytic cracking product (O.N.60-68 for hydrogenation, 76-81 for catalytic cracking), hydrogenation will aim at maximum increase in hydrogen content of the middle oil and minimum conversion to petrol. This can be

(*continued on page 379*

Oils & Chemicals from Coal

Report of the Fuel Research Board for 1949-50

TRANSITION from short-term wartime researches to post-war reconstruction projects caused the Fuel Research Board to decide to issue its last report to cover the three-year period 1946-1949 (THE CHEMICAL AGE, **65**, 721-726), and then to resume the pre-war practice of presenting reports annually.

As a first step to attaining this object, the board has now issued its report of the activities of the Fuel Research Station, Greenwich, for the 21 months 1 April, 1949, to 31 December, 1950 (HMSO, 2s. 8d., post paid).

During the period under review there was some increase in accommodation and facilities with the erection of temporary laboratories and the re-arrangement of existing buildings, but the difficulties in recruiting staff and obtaining equipment were by no means overcome.

A specialist Commonwealth conference on fuel research and the Fourth World Power Conference were held in London, in July, 1950.

Sulphur Supplies

Because of the deterioration of the position of this country with regard to supplies of sulphur, increasing attention was paid to the problem of recovering more sulphur from coal, and the station had taken an active part with the other competent authorities in preparing an exact assessment of the possibilities of improving indigenous supplies of sulphur.

In collaboration with a Working Party set up by the Board of Trade, information was obtained on the economics of recovering sulphur as spent oxide from coke-oven gas and of extracting the sulphur from this spent oxide in a form pure enough to be burnt in contact acid plants. A report was submitted to the Board of Trade and a more general document reviewing the whole position was prepared for the Organisation for European Economic Co-operation.

Under the heading chemical examination of coal, investigations were carried out into its constitution, analysis, and the occurrence of germanium in a representative selection of British coals.

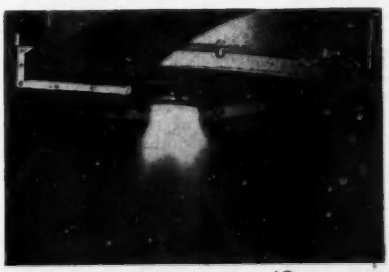
With the object of conserving as far as possible the reserves of the first-grade coking coal, of which there is a particular shortage, large-scale experiments were put in hand, in collaboration with the National Coal Board, to examine the possibilities of producing satisfactory metallurgical coke by carbonising blends of this first-grade coking coal with other more plentiful coals.

Experiments were continued on the gasification of fine low-grade coals and cokes in order to provide producer gas, water gas, and gas for the synthesis of oil. Applications of the 'fluidised-solids' and 'suspension' technique had been studied.

Investigations of tars, oils, and chemicals must always form an important part of the research programme of the station. Study of the Fischer-Tropsch synthesis had been the most important item in this field in recent years, and seemed likely to remain so for some time. During the period under review, work on the Fischer-Tropsch process based on cobalt catalysts had been brought to a close. Iron catalysts were found to be cheaper and more flexible with respect to operating conditions.

While, therefore, the investigation of the synthesis under a wide range of conditions had been continued in laboratory-scale reactors with both cobalt and iron catalysts, the studies which aimed at process development had been concerned with the use of iron catalysts in the fluidised-catalyst and liquid-phase processes.

The scale of the work on the Fischer-



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The vortex combustion chamber under test, when burning 350 lb. of coal an hour

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Modified reactor and its ancillary apparatus used in the liquid-phase Fischer-Tropsch process

Tropsch process was being extended to include the operation of a pilot plant to produce 30-50 gallons of products a day. This would not only provide chemical engineering data regarding the use of the fluidised-solids technique and the control of an exothermic reaction necessary for the erection of Fischer-Tropsch plants, but but would also be of interest in a wider field.

Further experimental work had been carried out with iron catalysts at 20 atmospheres pressure and at temperatures of 300 to 320°C. in the 1 in. by 10ft. fluidised-bed reactor. The particles of catalyst were within the range of 72 to 170 B.S. Test sieve sizes. In the operation of this plant, formation of carbon dioxide was suppressed and the linear gas velocity necessary for fluidisation was maintained by recirculating three to 10 volumes of residual gas with each volume of fresh synthesis gas. In the first nine runs the cooled residual gas was expanded to atmospheric pressure, the C_3 to C_6 hydrocarbons removed by active-carbon scrubbers and the requisite volume of stripped gas re-compressed to 20 atmospheres together with fresh synthesis gas.

During the period under review this procedure was modified by the installation of a diaphragm-type pump to recirculate cooled but unstripped residual gas at the operating pressure. With this method of operation the yields of C_5 and higher hydrocarbons had materially increased at the expense of the C_3—C_4 hydrocarbons. This desirable result was accompanied, however, by increased formation of free carbon and of methane and by some reduction in the degree of unsaturation of the products. With both methods of operation, a fused ammonia-synthesis catalyst gave lower yields of liquid hydrocarbons and water-soluble compounds containing oxygen, and higher yields of methane, than the sintered mill-scale catalyst.

Formation of carbon during synthesis caused disintegration of the catalyst particles so that the density of the fluidised bed decreased and the bed expanded. Best results from all points of view were obtained when using a mill-scale catalyst diluted and expanded by carbon formation so as to contain about 200 g. Fe per litre, as compared with 1,800 g. Fe per litre for freshly reduced catalyst.

Extensive use had been made of glass models to study the mechanics of fluidisation of catalysts in various stages of disintegration through carbon formation.

As a result of preliminary experiments with slurries of iron catalysts, the 2 in. diameter liquid-phase reactor was increased in height to 4 ft. and means were provided for returning condensed heavy oil to make up for loss by volitilisation, and also for withdrawing liquid medium free from catalyst.

Tests were carried out at 265°C. and 20 atmospheres with a suspension of finely powdered reduced ammonia-synthesis catalyst in molten wax. The synthesis gas used contained hydrogen and carbon monoxide in the ratio 2 : 1. Results showed that, with other variables constant, depth of the slurry through which the synthesis gas passed was not a significant factor.

Proportion of gas that reacted and the yields of products appeared to be controlled by the gas throughput per volume of slurry, rather than that per volume of catalyst. Best performance was obtained with a slurry containing about 300 g. of reduced catalyst per litre. These results for slurries of catalyst in oils were in many ways analogous to those obtained for fluidised catalyst diluted with carbon.

Using a slurry of the most favourable concentration, evidence was obtained that the maximum gas rate consistent with a

satisfactory conversion was of the order of 500 volumes of fresh gas per volume of slurry per hour.

When all the conditions (temperature, gas rate, and so on) were the same, production of methane was lower in the slurry experiments than for either fixed-bed or fluidised-bed operation, and the yield of liquid and solid hydrocarbons was similar or somewhat greater.

Products of synthesis on being condensed from the gases leaving the catalyst, separate into an aqueous and a non-aqueous layer. The aqueous layer may contain considerable amounts of neutral organic materials, mainly alcohols, particularly in the case of synthesis with iron catalysts, so that a routine method had to be worked out for their determination. The following procedure was found to be satisfactory.

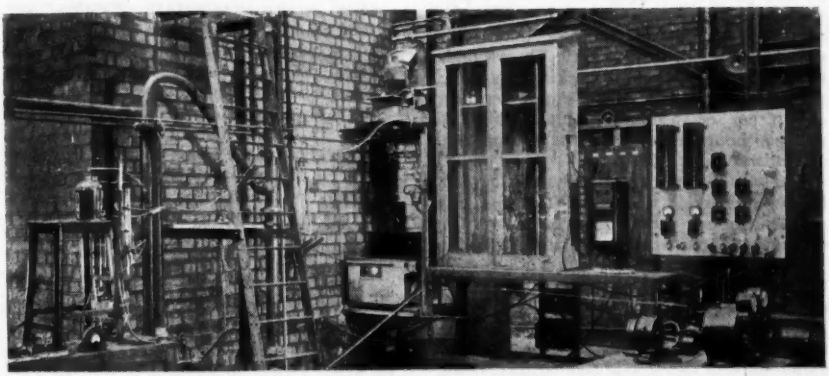
A sample of 100 ml. of the aqueous product was saturated with potassium carbonate, extracted with ether, and the ether removed by accurate fractionation. The individual alcohols present could be determined by distilling the residue with an excess of toluene, which gave well-defined azeotropes with ethanol, *n*-propanol and *n*-butanol.

The effect of the reaction conditions on the proportion of alcohols in the products had been investigated. Temperature and pressure were found to have the greater influence, the proportion of alcohols increasing with fall of reaction temperature and with increase in pressure. An increase in the rate of gas flow, and a decrease in the ratio H_2: CO in the gas both favoured the production of alcohols. Omitting the usual oxide promoter from the cobalt catalyst reduced the alcohol content of the products but addition of alkali increased it.

Increasing attention was now being paid to the application of physical instruments and of the techniques of physical chemistry as aids in solving problems of fuel technology. In the period under review the section of the Fuel Research Station dealing with X-ray and other spectrographic work had been reorganised and extended and an infra-red spectrometer had been installed.

Studies of distillation techniques had continued, and a special section had also been set up to study the more fundamental aspects of adsorption and other surface phenomena on catalysts, with a view to elucidating the mechanism of some catalytic reactions which figured so largely in the processes of hydrogenation and synthesis of hydrocarbons. The Brunauer, Emmett and Teller method for the determination of the surface area of powders by measurement of the adsorption of nitrogen at low temperatures had been applied to a variety of problems and an improved form of apparatus had been constructed and was now in use.

Following the experimental work described in the last report, attention had been directed to the consideration of a process in which ammoniacal liquor is employed for



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Removal of sulphur compounds from flue gas. Experimental plant for the Fulham-Simon-Carves ammonia process

the removal of sulphur compounds from flue gas.

Before the war Messrs. Simon-Carves and the Metropolitan Borough of Fulham suggested that sulphur compounds could be removed from flue gas by scrubbing with ammoniacal liquor.

A pilot plant was erected for the study of the process but it was not entirely successful in its operation, as it was found impossible to maintain conditions under which neither ammonia nor sulphur dioxide was lost in the gas leaving the scrubber. An electrical method was subsequently developed for measuring and recording the vapour-pressures of sulphur dioxide and of ammonia in equilibrium with the scrubber liquor and by this means it was hoped that the composition of the liquor could be controlled.

Pilot Plant Erected

Since the success of the process was dependent on the satisfactory control of the composition of the liquor in the scrubber and since the proposed electrical vapour pressure recorder had not up to then been used to control a scrubber—not even on the laboratory scale—it was decided, after discussion with the DSIR Working Group on the Removal of Sulphur Compounds from Industrial Gases, the British Electricity Authority, and Messrs. Simon-Carves, that a small pilot plant should be erected at the Fuel Research Station.

This was designed to treat 1,000 cu. ft. of flue gas per hour, taken from a Lancashire boiler, under conditions approximating as closely as possible to those that would obtain on a full-scale plant. These conditions required a scrubber packing 3 ft. long, a linear gas velocity in the empty scrubber of 5 ft. per sec., a liquor circulation of 2,000 gal. per hour per sq. ft. cross section, and a temperature of 50°C.

The scrubber itself was a Pyrex tube 3 ft. long and 3 in. in diameter filled with thin wooden egg-box packing of 1 in. 'pitch'. The scrubber liquor, which was circulated at a rate of 100 gal. per hour, was a solution of the approximate composition (per cent): ammonium sulphate 28-34; ammonium sulphite 0-6; ammonium bisulphite 0.75-5; ammonium thiosulphate 4-11 per cent, to which ammonia was added at a rate corresponding to the rate of absorption of oxides and oxy-acids of sulphur. On a large scale, the heat of the incoming flue gas would maintain the scrubber temperature at about 50°C., but on the present scale it was necessary to supply heat to attain this temperature.

As a scrubber, the plant described was found to be entirely satisfactory and when the composition of the liquor was right, the concentration of sulphur dioxide in the exit gas was found regularly by analysis to be as low as 0.0005 per cent, which corresponded to the removal of some 99 per cent of the sulphur dioxide in the flue gas.

At this stage the plant was shut down for about three months, and when it was re-started control was found to be even easier, with no added catalyst. It is probable that this was caused by the rusting of the plant, with the particles of rust or rusty surfaces acting as efficient oxidation catalysts.

Sulphuric Acid Treatment

Production of ammonium sulphate from the scrubber liquor was similar to the Katasulf process that was worked out in Germany before the war, and was effected by heating the liquor in an autoclave to 190°C. with the requisite amount of sulphuric acid. During this treatment the sulphite and thiosulphite were decomposed and gave sulphur and ammonium sulphate.

Following the promising results from this small pilot plant it was decided by the DSIR Working Group that the process should be operated on a larger scale. A plant to deal with 25,000 cu. ft. of flue gas an hour was being erected at the station.

The vortex combustion chamber, described in the last report, consisted of a shallow cylindrical chamber with its axis vertical. The top and bottom walls were made of heat-resisting steel and the circumferential wall was of refractory brickwork. The main bulk of the air required for combustion entered the chamber through tangential ports in the circumferential wall and the products of combustion followed a spiral path to the centre of the chamber before leaving it through a central opening in the bottom plate.

Pulverised coal was carried into the chamber by the primary air through six nozzles in the top plate. As a result of the relative motion between the air and the coal particles combustion was extremely rapid and the heat liberated per cubic foot of combustion space was much higher than in a normal boiler furnace.

Carbon Monoxide & Water

Recent German Work on the Synthesis of Hydrocarbons

COMPARED with the vast amount of work undertaken on the direct synthesis of hydrocarbons from carbon oxides and hydrogen, as in the Fischer-Tropsch synthesis, that relating to the use of carbon monoxide and water for a similar end is relatively small—but none the less important. In a paper read at the meeting of the German Chemical Society in Cologne last September, Drs. H. Kölbel and Fr. Engelhardt (Rheinpreussen A.G. für Bergbau & Chemie, Homburg) described some of their work in this direction, an extract from which has now been published (*Angew. Chem.*, 1952, **64** (2), 54-58, 21 January). They appear to have succeeded in achieving a one-stage conversion with high yields. Previous reports on this hydrogenation of CO include *Proc. of 3rd World Petroleum Congress*, 1951, also German patents and applications.

The apparatus used is shown in Fig. 1. The CO passes in measured flow to a compressor, thence through a pressure booster, a three-stage pressure-reducer, and a flow-meter, to the water evaporator, to which measured amounts of water are fed through a pressure pump. The amount of water to be evaporated is controlled through temperature regulation according to the desired partial pressure and CO pressure. When the CO stream has thus been charged with a certain amount of water vapour it passes to an electrically heated reaction tube in which granulated (pelleted) catalyst is disposed, and thence into a small condenser for the liquid products. The expanded final gas goes through a flow meter to a $CaCl_2$ tube for determination of the unconverted water vapour, and two active charcoal tubes (AK) for absorption of the gas-oil hydrocarbon mixture, and finally into a gasometer. Between the two AK tubes is inserted a continuous CO_2 washer.

Some operating data and results are as follows: temperature—preferably 210-260° C.; pressure—normal and super; space velocity—1,000 or more; ratio H_2O vapour/CO—less than 0.5; catalyst—Fe, Co, Ni, and others; H_2O and CO conversions—both over 90 per cent; yields—up to 216 g. hydrocarbons and oxy-compounds per cu.m. of CO used; composition of products—paraffin hydrocarbons (methane and higher), up to 60 per cent olefins, and 40 per cent oxy-compounds. Several catalysts other than those named were used, with varying results. The reacting elements must be in strictly definite and somewhat narrowly defined limits. Thus, for hydrocarbons:—

$$H_2O + 3CO \rightarrow (-CH_2-) + 2CO_2 \quad \ldots \quad (1)$$

and for alcohols (ethyl):—

$$3H_2O + 6CO \rightarrow C_2H_5OH + 4CO_2 \quad \ldots \quad (2)$$

These ratios are further illustrated by graphs, in the original, for hydrocarbons, ethyl and cetyl alcohols, showing the decline in theoretical yields with deviation

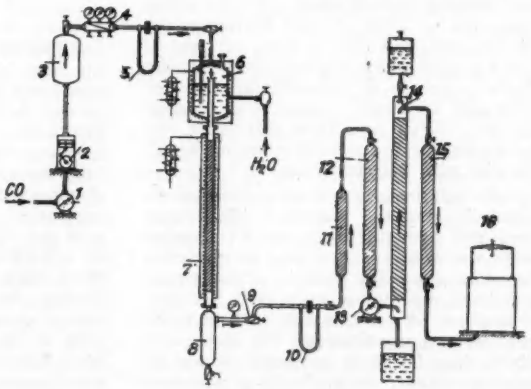

***Fig. 1.** 1 Gas meter, 2 Compressor, 3 Pressure booster, 4 Pressure reducer, 5 Flow meter, 6 Evaporator, 7 Electrically heated synthesis furnace, 8 Condenser, 9 Pressure release expansion, 10 Flow meter, 11 Calcium chloride tube, 12 Active carbon tube, 13 Gas meter, 14 CO_2 washer, 15 Active carbon tube, 16 Gasometer*

from the ideal ratio. The effect on the catalysts, too, was rather remarkable unless the required ratio was strictly adhered to, for only then did they function effectively. Excess CO led to carbon deposition, and excess water to oxidation. This is exemplified in the paper by a graph for an iron catalyst.

Gas Flow/Time Ratio

Another important factor in maximum efficiency is the gas-flow/time ratio, or so-called space (volume) velocity (*Raumgeschwindigkeit*), which is governed by reaction rate at the contact surface, and of course involves the duration of contact by the reacting elements. The authors discuss the effect of pressure in this respect, illustrated by graphs, with pressures up to 100 atmospheres. There was a strictly linear relation, the space velocity (abscissae) being about ten times the pressure in atmospheres (ordinates). Under 100 atmospheres pressure it was 1,000. This relation held within narrow limits throughout the range. It is pointed out that earlier experience with the Fischer-Tropsch reaction would not necessarily suggest such pressure effects. With increasing pressure there was also some slight increase in yields, largely through increased oxygen content.

With regard to temperature, this must be adjusted for maximum catalyst activity, but not so high as to cause undesirable side reactions, such as premature methane formation or carbon deposition. Tests with a freshly reduced iron catalyst showed that under normal pressure at 200°C., the water-gas reaction predominated; yet even with a slight rise to 210°C. the CO conversion was 90 per cent, and rose to 93-97 per cent at 250°C., after which it slowly declined with further increase of temperature. Methane formation increased rather considerably beyond 240°C., and from this point the production of hydrocarbons was no longer parallel with CO conversion.

Although in most of these experiments relatively pure CO was used, other cheap industrial gases of fairly low CO content were also tested, with a view to maximum economy in working; such for example were generator and furnace gases, with no more than about 30 per cent CO, and up to 60 per cent or more, nitrogen. The main point about these is that they should contain no catalyst poisons, and preferably a minimum of hydrogen. The expected inconvenience of so much inert ballast, which reduced the CO partial pressure, did not seriously materialise. CO conversion reached 97 per cent at a temperature of 235°C., with pressure at 10 atmospheres, and RG (volume flow) 100-200; H_2O/CO ratio was 1: 3, and time 240 hours or more.

Metals of the 8th group were most suitable for use as catalysts in the new synthesis, especially iron; also cobalt and nickel, with which, however, methane formation was greater than with iron. The chief desiderata here are maximum activating power at minimum temperature, and maximum selectivity in stimulating the required reaction without digression into side reactions, such as are well-known in the Fischer-Tropsch syntheses: CO decomposition, oxidation, water-gas reaction, etc.

To this end certain catalyst auxiliaries may be useful, such as nitrogen in the ferrous metal lattice or the addition of difficultly reducible oxides like alumina and/or of alkali salts. Copper or silver facilitate reduction and conversion of the catalyst into the desired physical condition at low temperatures and the avoidance of sintering. Carriers, too, may be employed, namely, dolomite or kieselguhr, if solid catalysts are used, but not if these are in the liquid phase, as they are in oil suspensions. For reduction, hydrogen or carbon monoxide or gases containing these may be used. The authors' catalysts remained active for well over 1,000 hours, with a charge of 7 litres initial gas mixture per g.Fe (per hour).

Chief Products Formed

The products formed are chiefly saturated and unsaturated paraffins, with olefins ranging from 35-60 per cent according to conditions, and up to solids in the homologous series. Alcohols may also be produced, especially at pressures above 30 atmospheres, with minor amounts of aldehydes, fatty acids, and esters. Ethyl alcohol predominates here. By way of an example, percentage composition of product obtained at 0 and 100 atmospheres, at a temperature of 235-238°C., are tabulated in the paper. Work with heterogeneous catalysts is proceeding, but is not yet completed or reported, except provisionally (*Erdöl & Kohle*, 1049, **2**, 52; *Chem. Ind. Technik*, 1950, **22**, 97). The subject matter of this report is under patent application.

Iodine as a Negative Catalyst

Some Applications of the Element & Its Compounds

MORE than half a century ago Wilhelm Ostwald defined a catalyst as any substance which alters the velocity of a chemical reaction without appearing in the end-product. Since this famous definition was put forward, enormous advances in the field of applied catalytic chemistry have taken place, but a complete understanding of catalytic phenomena has not yet been achieved.[1] Attention has been directed mainly to applications in which a chemical reaction is speeded up by the presence of a positive catalyst, but there are also many useful and specialised applications for substances which decrease the velocities of chemical reactions and are therefore termed negative catalysts or inhibitors. This interesting branch of catalytic chemistry has been comparatively neglected, though the behaviour of negative catalysts has been discussed extensively by K. C. Baily in his authoritative work, 'The Retardation of Chemical Reactions'.

Since it is easier to find out the factors responsible for slowing down a reaction than those which hasten it, negative catalysts are of scientific value in studying the mechanism of catalysts. They are also finding practical applications as fire preventatives, anti-knock agents in motor fuels, bread improvers, anti-oxidants in rubber products, and inhibitors of metallic corrosion. Greater knowledge of the mechanism of catalysis will doubtless open up further possibilities for the development of useful applications.

Mechanism of Negative Catalysis

Several theories to account for the behaviour of negative catalysts have been advanced, the most important being (*a*) breaking of chain reactions, (*b*) formation of intermediate compounds which have great stability, and (*c*) the production of intermediate compounds which decompose to regenerate the catalyst and the original reactants. The third theory is supported by the behaviour of water in decreasing the velocity of such reactions as esterification and alcoholysis, which proceed rapidly in anhydrous media, and by the ability of certain groups of organic compounds to inhibit the formation of polymers in mineral oil and to retard the oxidation of rubber.

Iodine and its compounds have found several technical applications as negative catalysts. As long ago as 1898 M. Centnerszwer reported that certain organic compounds of iodine—allyl iodide, methyl and ethyl iodide and iodobenzene—were the most effective of a number of organic compounds studied as inhibitors of the combustion of phosphorus in air.[2] This work directed attention to the potential applications of the inhibitive effects of iodine and its compounds in fire and explosion prevention.

Anti-Knock Agents

To enable the design and efficiency of internal combustion engines to be improved, a need arose for materials capable of retarding the detonation of combustible mixtures of air and hydrocarbon vapours. Iodine was found by T. Midgley and T. A. Boyd to be a suitable agent for this purpose, but it was superseded by lead tetraethyl, which has a greater effect on detonation and has become the universal anti-knock compound. Another good example of a negative catalyst is the use of 0.1-1.0 per cent of potassium bismuth iodide to inhibit the polymerisation of acrylic acid or its derivatives.[2]

It is for retarding combustion and explosive reactions that iodine and its compounds are likely to be most extensively used as negative catalysts. For nearly every mixture which is combustible in air, there is a maximum and a minimum partial pressure of oxygen within which limits combustion occurs. If oxygen pressure is outside these limits combustion cannot take place. One method of investigating the fire preventive power of iodine, therefore, is to study the effect of additions of iodine compounds on the limits of inflammability of mixtures of air and combustible vapours. This method was used by Y. Tanaka and Y. Nagai, whose studies on the inflammability of hydrogen-air mixtures showed that the molecular proportion of hydrogen in the upper limit mixture was reduced from 71.2 per cent in the absence of alkyl iodides to 50 per cent in the presence of 0.79 per cent of ethyl iodide and to 50-55 per cent in the presence of 0.95 per cent methyl iodide.[3] Further work by

Nagai indicated that methyl iodide was also effective in narrowing the limits of inflammability of mixtures of ethyl ether and air.[4]

Another line of investigation is to study the effects of inhibitors on the spontaneous ignition temperatures of mixtures of combustible materials and air. Inhibitors which narrow the inflammability limits of such mixtures are usually effective in raising the spontaneous ignition temperatures of hydrocarbon-air mixtures, and therefore have potential value as explosion preventives. Methane has the fairly high spontaneous ignition temperature of 634°C., but with modern shot-firing methods of mining, it is desirable that every precaution should be taken against the risk of fire or explosions. Among the many inhibitors tested in methane air mixtures, ethyl iodide and iodine have been the most effective.

Inhibiting Coal-Mine Explosions

Tests of coal-mining explosives were described by Payman in a paper presented to the Institute of Mining Engineers in 1930.[5] There are three ways in which an inhibitor may be used with a coal-mining explosive, namely as an admixture with the explosive itself, in the atmosphere surrounding the shot hole, or between the explosive and the surrounding atmosphere (that is, as a stemming or as a safety sheath). Payman pointed out that the admixture of inhibitors in the shape of cooling salts to the explosive itself had already been exploited to the limit. The presence of an inhibitor in the atmosphere appeared to be the most logical method, but in view of the large quantities of air used to ventilate a coal mine, it was evident that the cost would be prohibitive. There remained the use of the inhibitor as a stemming or safety sheath. Various substances had been suggested for this purpose, but their value would be tremendously increased if a true inhibitor could be found, which would act by virtue of its chemical rather than its physical characteristics, especially if it could be used in a relatively small quantity, comparable with the low concentration of anti-knock compounds in internal combustion engines.

Payman then stated that the Safety in Mines Research Station, Buxton, had obtained very encouraging results from the use of an organic compound, ethyl iodide, as an inhibitor. Only two parts of this compound in one thousand parts of a methane-air mixture raised the ignition temperature from 634°C. to 759°C., thus producing a remarkable decrease in the inflammability of the mixture. During the discussion on Payman's paper H. B. Dixon stated that iodine was as effective in raising the ignition point as ethyl iodide.

Although it was stated that these important observations would be made the basis of further research work, the high cost of adding inhibitors to the atmosphere to prevent fires and explosions evidently proved an obstacle to the development of applications on a complete technical basis. In 1939, however, a report by Jorissen and Lebbink indicated that similar inhibitive effects might be obtained by coating with alkali iodides the walls of vessels containing combustible or explosive mixtures.[6] A subsequent report by Jorissen[7] confirmed that the presence of alkali iodides retards the explosion of methane-air mixtures and showed that iodides are also more effective than fluorides, bromides or chlorides in increasing the temperature at which methane-air mixtures undergo catalytic oxidation.

The work of Jorissen and Lebbink suggests that if the walls and floors of the cuttings were dusted with alkali iodides, the dangers of fires and explosions in coal mines could be minimised. For situations in which the atmosphere is stagnant, the addition to the atmosphere of an inhibitor, such as iodine, methyl iodide or ethyl iodide, is more appropriate. In circumstances where the fire hazard lies in the possible escape of inflammable vapour or liquid into the atmosphere, the addition of iodine or a soluble iodine compound to the inflammable material is the most satisfactory method of reducing the danger.

Infra-red Spectrographic Crystals

In 1946 the Chilean Iodine Educational Bureau were collaborating with a commercial firm interested in the production of crystals for infra-red spectrographic analysis. Potassium iodide is among the most important substances employed in this modern branch of science. Its crystals are difficult to grow, but have the advantage of being able to transmit to about 40 microns. A technique of fusing and rapid cooling has now been evolved, whereby crystals of the large size desired can be successfully produced.

While experts from the Bureau were

engaged on this investigation, they were asked about the feasibility of using iodine as a fire-preventive agent. A large number of high-speed quartz machines were employed at the factory, and local fires frequently occurred due to the flashing of cutting oil dispersed as a spray. Each cutter was therefore kept in its own compartment. The addition of one part of iodine to ten thousand parts of cutting oil completely eliminated these fires.

In view of this remarkable indication of the potential value of iodine and its compounds as fire and explosion preventatives, officers of the Bureau investigated the literature again in search of subjects capable of practical developments. It was decided that further research work was required and methyl iodide was eventually selected as a suitable compound for consideration as an inhibitor which might find technical applications. It was volatile and by analogy with methyl bromide should be an effective fire preventive. Further tests confirmed this opinion and showed that methyl iodide was extremely efficient in extinguishing petrol fires.

Drawbacks to Methyl Iodide

There seemed to be two possible objections to the use of methyl iodide for putting out fires. In the first place this compound is expensive, and it would therefore be necessary to persuade manufacturers that the high cost was due in part to low consumption, so that a reduction in price could be anticipated if larger quantities were used. The second drawback was the possible degree of toxicity, which at that time had not been investigated. All existing chemical fire-extinguishing agents are toxic. Methyl bromide is extremely so and has caused quite a number of field casualties. Carbon tetrachloride, though an efficient extinguisher, is not entirely satisfactory, because when applied to a fire it decomposes and releases phosgene, which is a powerful poison. It has the advantage of cheapness, however, and there is at present no chemical available in bulk which is more suitable for portable extinguishers intended for use in unconfined spaces. Methyl iodide appeared to have favourable prospects, however, until the advent of chlorobromomethane, which was developed by the Germans during the 1939-45 war. Less toxic than the other compounds mentioned and not unduly expensive, chlorobromomethane is coming into wide use in the United States and is possibly the chemical fire extinguishing agent of the future.

Since methyl iodide and chlorobromomethane are most likely to be required for use on petrol fires, the Fire Research Station has studied their effect on the inflammability limits in air of *n*-hexane, which has combustible properties similar to those of petrol. The experiments were carried out by the standard inflammability limit method, methyl bromide, carbon tetrachloride and 'Freon 12' also being included in the series. The results showed that carbon tetrachloride and 'Freon 12' were less effective than the other three agents when used for extinguishing fires involving combustible liquids.[6]

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High-Pressure Hydrogenation

Continued from page 370

achieved by operating at relatively mild temperature conditions. The rehydrogenated gas oil is forwarded once again to the catalytic cracker. Thus there will be continuous exchange of gas oils at different degrees of hydrogenation between the vapour-phase high-pressure hydrogenation unit and the catalytic cracker.

The overall yield of a process designed along these lines will be about 70 per cent petrol (by weight) and 21 per cent L.P. gases. The clear octane number of the butane-free petrol will be between 78 and 20, depending on the nature of the original feedstock.

An even higher yield, though at the cost of gasoline quality, is made possible by an alternative scheme, in which virgin gas oil is fed to the catalytic cracker. The topped residual cracking middle oil is charged to a vapour-phase hydrogenation unit using diluted WS_2 catalyst. The product from this phase is intermediate in quality between that from catalytic cracking and that from hydrogenation over pure WS_2. There is no recycle from this hydrogenation to the cracker. Rather, gas oil in the making is recycled to the hydrogenation phase itself.

Canadian Plastics Industry in 1951

Now Second Largest World Exporter

THE plastics industry in Canada in 1951 experienced relatively good business conditions, reports V. G. Bartram, president of Canadian Resins and Chemicals, Ltd., in his annual review, with the first six months contributing the major share of the sales volume. The latter part of the year was considerably slower, due to a combination of factors such as heavy inventories, credit restrictions and competition from U.S. products, which became more prevalent in the Canadian market due to a slow-down in business in the United States.

Influence of Defence

Although only a limited defence programme has been defined, the industry was conscious throughout the year that at any time such a programme might be initiated and its actions were governed to a certain extent by this consideration. The unique and varied properties of the plastics family which have been widely adopted in the U.S. for defence needs have not been exploited in Canada to a similar extent. However, it is satisfying that in its relatively short history, it has made rapid strides in developing production facilities to a point where Canada is becoming self-sufficient in such basic materials as vinyls, polystyrene, phenolics and polyesters. This independence has placed the industry in a most favourable position to meet Canadian defence needs.

The industry as a whole has continued to make progress in establishing its products as a standard material in many new industries. In addition new uses are being found for many plastic materials which will open new markets to this industry.

During 1952 it is expected that vinyls in moulded, extruded and calendered form will find increasing acceptance in the shoe industry and vinyl plastisols will be adopted for wet weather footwear.

For the first time foamed vinyl materials are being made in Canada and these have a tremendous potential as an insulation material in military and civilian fields. The list of such new applications which will become established within the next 12 months are legion, but it is products such as these which are encouraging the expansion of the entire industry.

This trend has led to many plant expansions being undertaken and the most notable expansions have taken place in the polyester, vinyl phenolics, urea, melamines, cellophane and cellulostic fields. It is of significance that large plastic plants are no longer limited to Eastern Canada, since a cellulose plant has been established in British Columbia during 1951 and a polyethylene plant will be established in Alberta during 1952.

Changes in the international situation will definitely have an effect on both the export and domestic markets. It is hoped that industries in general will have adjusted themselves to the restrictions imposed by the government credit regulations and that an increased volume of business will result. It is anticipated that the purchasing pattern will be more level in 1952 than during the past year, and although the volume of sales may not be as high as the first six months of 1951, the general picture should be satisfactory.

Canada has now risen to second place in the export market This position was attained in spite of dollar restrictions in many countries throughout the world. However, there are a large number of synthetic resin plants being erected throughout the world which may in the future affect the Canadian plastics exports.

Pentaerythritol Production

Pentaerythritol, used in the manufacture of explosives and alkyd resins, will soon be produced in sufficient quantity in Canada to supply all her domestic needs and also make her a major exporter of the material. At the present time, total Canadian requirements, amounting to approximately 3,000,000 lb. annually, are being imported from the U.S., but the completion of the Canadian Chemical Company's plant at Edmonton, Alberta, late this year will change this.

The new plant will also be in a strategic position for supplying the needs of the mid-western and far-western sections of the United States since all pentaerythritol production in that country has up to now been concentrated on the eastern coast. World-wide markets will be served by shipment from Vancouver.

A Survey of Textile Fibres

Future Developments Not Confined to Synthetic Fibres

SO many hymns are sung nowadays to the virtues of synthetic fibres that it is sometimes difficult to detect the limitations of these newcomers to the textile field, and to compare them fairly with the staple natural fibres, silk, wool, and cotton. An interesting paper by J. H. Dillon, director of the Textile Research Institute of Princeton, New Jersey, read to the Synthetic Organic Chemical Manufacturers' Association of America, in New York recently, gave a straightforward analysis of the textile fibre field. One of his main conclusions was that there is as much scope for the chemical industry in the field of natural fibres as there is in the more romantic subject of synthetic fibres.

The three most important properties of a fibre that affect its ultimate fate are its availability, its price and its comparative properties and superiority in any particular application. The oldest luxury fibre in the world, silk, still accounts for 0.1 per cent of America's present textile consumption, said Mr. Dillon, and for physical and chemical superiority has never been successfully imitated. Research on silk has been in progress at Princeton University, but the chief factors that tell against it are its comparative scarcity and its high price.

Improved Qualities

The other natural protein fibre—wool—has also never been copied with any success by the chemist; it is a highly complex arrangement of amino-acid residues with a remarkable response to stress that has never had a serious competitor among synthetic substitutes. Synthetic fibres have, however, been successfully blended with wool to give perfectly good fabrics, and in some cases these have improved qualities: thus, 'Dacron,' incorporated with wool in the fabric of a worsted suiting, imparts a remarkable permanence of crease; 'Dynel' blankets do not shrink when washed, as well as being equal to wool in warmth and proof against moths; and, as many men know, 'Nylon' and 'Orlon' both improve wear-resistance and reduce the felting shrinkage of woollen socks. Wool, said Mr. Dillon, also has an advantage over silk at present, because it is in the hands of more progressive producers. One example of this that he quoted was the operation on ewes introduced by Australian sheep farmers to reduce the deleterious effect of urine on the wool of the underparts.

Resilience Important

On the debit side mothproofing has never really been completely overcome in wool, although there are several effective commercial treatments. It is not a strong fibre, the strength being only 1.3 g. per denier at 70° F. and 65 per cent relative humidity, and 1 g. per denier wet. The dry strength is adequate and it behaves moderately well under wet conditions compared with any of the regenerated protein fibres. Any increase in strength would mean a loss of resilience—one of wool's greatest advantages. The same applies to an increase in abrasion-resistance, although admixtures, as pointed out above, can be satisfactory. Future developments may make wool usable in products where previously its mediocre wearing properties have made it unsuitable.

The moisture absorption, swelling and dyeing characteristics of wool, however, are excellent, as are its retention of crease—provided it does not get too wet. Further research on the nature of the keratin in wool may result in improvements elsewhere. A recently discovered improver is β-propiolactone, which has been found to have good effect on the mechanical properties and rate of felting of wool. One remarkable fact about wool as a fibre is its uniform properties, regardless of origin or diameter of the yarn.

Most used of the natural fibres is, of course, cotton, which comprises 70 per cent of America's textile consumption. Here again, nature has defied the chemists, largely because of the high molecular weight and complicated stereochemical structure of cotton, and the increase in the weight of fibre used during the last 20 years in America has been as great as that of viscose rayon. In contrast to wool, cotton is stronger wet than dry—Lancashire dampness therefore suits it—and is strong, but relatively inelastic. Recent improvements are

towards improving its crease-resistance by resins and cross-linking reactions. Attempts to make it more elastic, however, have meant the sacrifice of cotton's crystallinity—one of its fundamental virtues, if bulky side-groups are introduced and the structure swollen. Resilience might be introduced by giving it a stable crimp by chemical and physical treatment. Disadvantages of cotton are its inflammability, susceptibility to microbiological attack, hydrolysis and oxidation, and its variations from crop to crop, area to area, and fibre to fibre. These factors are being extensively studied.

In the field of regenerated fibres, viscose rayon is most used; in 1930 consumption in America was 3 per cent of total textiles. In 1950 it was 20 per cent. Staple viscose rayon has a bright future—it is reasonable in price and continually being improved. Recent research has made it more wrinkle-resistant and has reduced chlorine retention and odour, and it is now a high quality fibre. Shortcomings, however, are its lack of resilience and loss of strength with increasing moisture. These regenerated protein fibres are finding interesting applications in blended yarns, where they add an unusual 'loft,' their lower wet strength being no serious defect.

With synthetic fibres, the present fashion appears to demand progressively lower regain, or shrinkage, from 3.8 per cent for 'Nylon' to 0.4 per cent for 'Dynel.' In dyeing, it has proved possible to insert the dye molecule into the structure of the fibres, but often it cannot be made fast, resulting in preferential 'crocking' in certain parts of a garment. The introduction of hydrophobic synthetic fibres has increased the difficulties of dyeing. Often these fibres, especially the acrylics, do not swell sufficiently to allow the large dye molecule to penetrate the fibre at all. Sometimes acetate dyes work well, and several chemical tricks have been devised and are effective.

Physico-chemical Research

Hydrophobic synthetic fibres, being better dielectric materials than older fibres, generate static electricity, which attracts dirt and dust on to their surface. Progress has been made in developing finishes to dissipate this static charge, some of these even resisting laundry and dry cleaning effects, but there is still room for basic physico-chemical research on the nature of tribo-electricity in hydrophobic fibres and its relation to molecular structure.

Another fault that has become prominent with the introduction of synthetic fibres is 'pilling.' With high-tenacity fibres it is a very difficult problem, even in 50-50 blends with wool and 100 per cent synthetic blankets and socks. 'Wicking' is another unpleasant feature of hydrophobic synthetic fibres. If one wears 'Dacron' trousers and it starts to rain, every raindrop landing on the material soaks immediately through to the skin. This effect is a function of surface wetting or 'contact angle,' with the yarn, fabric geometry also playing a part. It is clear that there is much room for research in all sections of the synthetic fibre industry, as well as in the natural fibres.

Colour Range for Paints

A MATTER of increasing difficulty for the paint industry is the tendency of paint specifiers to ask for special colours to be supplied, even using their own colour ranges when ordering and thereby adding to the already large number of existing colours which are being demanded from paint manufacturers often, unfortunately, in uneconomical quantities.

This practice causes relatively large amounts of capital and scarce raw materials to be locked up in unnecessary stocks of paints and colours that are very near duplicates, wasteful both for the industry and for the national economy. In order to remedy this and to put into practice recommendations put forward by the Anglo-American Council on Productivity, the Paint Manufacturers' Co-operation Committee has instituted a Paint Industry Colour Ranges Committee with the object of compiling a single range of colours which, it is hoped, will be acceptable to Government departments, local authorities, and bodies of a similar nature. The list is being compiled in consultation with the BSI, the British Colour Council, and the Paint Research Station, and will not be finally agreed upon until it has been found acceptable by Government departments and other bodies concerned. The address of the Colour Ranges Committee is Grosvenor Gardens House, Grosvenor Gardens, London, S.W.1, and suggestions and comments should be sent to it there.

Delaney Committee Evidence Conflicts

Food Colours & Estrogens Said to be Carcinogenic

CONFLICTING evidence being produced before the Delaney Committee investigating chemicals in foods, in Washington, recently concerned the use of stilboestrol to fatten chicks, and the use in food of certain certified food colours.

A physician employed by the Eli Lilly Company, basing his evidence on his own observations and those of research workers in the field, is reported in *Chemical and Engineering News* to have said that intermittent administration of diethyl stilboestrol to humans caused no harmful effects, and permanent or serious side effects were only seen when large doses were given continuously for considerable periods of time. He said that he had never encountered any evidence that the administration of stilboestrol or any other estrogen had been a factor in the origin of cancer in humans.

He also said that diethyl stilboestrol did not make the flesh of chickens dangerous for people to eat, that the dimethyl ether *did* show a lingering effect of the estrogen, but that this derivative was not used in treating chickens. Clinical studies, he said, showed that people who might eat an undissolved tablet of stilboestrol in the neck of a chicken would suffer no harm, and that the amount of stilboestrol used persisted in the body for only three or four days.

Dr. Hueper, of the National Cancer Institute, thought very differently. He said that the use of estrogens was 'biological dynamite', and that he believed that their use over a prolonged period gave them carcinogenic possibilities. He therefore opposed their use by lay persons.

Suspected Dyes

In the field of food colours, Dr. Hueper thought that there should be a reinvestigation of all coal-tar dyes used for colouring food, since, he said, some were known to have carcinogenic properties, according to recent research results. An example he quoted was Light Green SF, which produced cancer at the site of injection into rats. In view of the practical difficulties involved in such an extensive study, Dr. Hueper recommended that a start be made on the dyes which were most suspected. The lack of relationship between toxicity and carcinogenic activity, he said, made it hard to study dyestuffs and other chemicals in foods.

Other evidence was given before the Committee by Dr. L. G. Cox, of the Beech-Nut Packing Company, concerning the presence of pesticidal residues in foods. Dr. Cox said that the quality control programme now in force in his company cost $111,000 a year, and had, since 1946 when it started, cost approximately $700,000. It ensured that all food products, especially baby foods, contained no pesticidal residues that might be harmful, or produce off-flavours. Prior to 1946, all that had been necessary was a simple wash to remove excessive residues such as lead and arsenic, but with the advent of newer pesticides, although higher quality fruit and vegetables resulted, problems had arisen of devising methods of analysing residues, of removing them, and of establishing tolerance standards. The company was examining various pesticides to determine which were both effective *and* safe, and to date analytical methods had been developed for DDT, DDD, Parathion, BHC, and Methoxy-chlor. There were, however, no good ones available yet for Chlordane, Toxaphene, Aldrin, Dieldrin, or Heptachlor. Elaborate field survey programmes and bioassay methods were used by his company.

Dr. Cox said he believed that controls could be kept at a minimum if a good research programme were initiated. He favoured testing of pesticides by the U.S. Department of Agriculture and state experimental stations, toxicity testing and fixing of tolerances by the U.S. Public Health Service, and enforcement by the Food and Drug Administration.

Uranium in Yorkshire

Slight traces of uranium are claimed to have been found at Sneeton, near Whitby, while boring for potash. This was revealed by L. R. Raymond (I.C.I. Ltd.) in an address to the Whitby Naturalists' Club on 29 February. Exploratory search of the Whitby district, said Mr. Raymond, showed extensive deposits of potash, while natural gas has been discovered at Eskdaleside.

German Chemical Progress

Latest Reports from Western & Eastern Zones

GROWING importance and efficiency of Germany's chemical industry will be well demonstrated by the scope and organisation of Achema X, the Chemical Plant and Apparatus Exhibition and Chemical Engineering Congress, organised by Dechema (Deutsche Gesellschaft für Chemisches Apparatewesen), which will be held in Frankfurt from 18-25 May.

Aims of the Achema exhibition and convention are set out in the official 'invitation', 65,000 copies of which are being sent out to scientists and firms in Germany and abroad, and which has been published in English, French, German, Italian and Spanish.

The 'invitation' takes the form of an illustrated brochure (quarto-size) of 24 pages which gives a vivid impression of the magnitude of the undertaking. Nine halls with a total area of approximately 37,200 sq. yds., the Convention Hall and other buildings on the Frankfurt exhibition grounds, as well as the Dechema Haus, will be required to accommodate the Achema X Convention, at which more than 500 firms (domestic and foreign) will be represented.

Development in laboratory equipment of all kinds will be displayed in Hall V by over 110 firms, while their latest examples of measuring and control instruments will be shown by 45 exhibitors in Hall III.

Materials for the construction of chemical plant as well as unit processes and complete plants for all branches of the chemical industry will fill Halls VIa, VII and VIII.

Importance of packaging materials and machines to the chemical industry will be brought home by demonstrations in Halls II and III where 35 firms will be represented.

Topics represented by special exhibition groups will include research, literature, standardisation, raw materials, and accident prevention and protective equipment.

The chemical engineering congress to be held in conjunction with Achema X will include the 25th International Congress of Industrial Chemistry of the Société de Chimie Industrielle, Paris, and meetings of the following European scientific societies: Asociación Nacional de Quimicos de España, Madrid; Institution of Chemical Engineers, London; Kemian Keskuslütto-Kemiska Centralforbundet, Helsingfors; Koninklijk Instituut van Ingenieurs, Afdeling Voor Chemische Technick, Amsterdam; Società Chimica Italiana, Rome; Society of Greek Chemists, Athens, and Verein Oesterreichischer Chemiker, Vienna.

Subjects to be discussed at this European Meeting of Chemical Engineering will be: 'Principals of Chemical Engineering'; 'Automatic Measurement and Regulation in Laboratory and Works; 'Continuous Chemical Processes'; 'Extreme Conditions in Chemical Processes'; and 'Corrosion and Materials of Construction'.

As at Achema IX, a programme of lectures has been arranged in the mornings so that an inspection of the machines and plant dealt with can be made in the afternoon. The series of talks will begin with an introduction on the significance of chemical plant and apparatus in science and industry and the provisional programme will cover laboratory technique; measuring and control; materials of construction; plant for chemical processes (parts 1 and 2); complete plants for chemical processes.

East German Sulphuric Acid

ACCORDING to a recent report in *Chemische Ind.* (January 1952, p. 8) out of a total German production of sulphuric acid of 1,441,000 tons (SO_3) in 1936, 302,000 tons was contributed by E. Germany, or about 21 per cent. Capacity in that zone rose to 500,000 tons in 1945, or about 22 per cent of total German capacity at that time; but owing to dismantling in 1945-6 it fell to 193,000 tons in E. Germany. From 1948, however, increased production was planned at works including the following: Fertilia-Werk, Coswig/Anhalt (VEB, or Volkseigener Betrieb), 324,000 tons in 1949 and since enlarged; Chem. Fab. Fahlberg-List Magdeburg (VEB) 32,000 tons in 1951; Chem. Fab. v. Heyden, Weissig/Kr. Grossenhain (VEB) 360,000 tons(?); Chem. Fab. Pommerensdorf, Oranienburg (VEB) 96,000 tons; Fertilia Salzwedel (VEB); Kali-Chemia, Werk Kanne, Berlin-Niederschöneweide (VEB) 12,000 tons; and many others, making a

total of at least fifteen factories, one or two of which are in the SAG (presumably Soviet Akt. Ges.).

Total capacity for 1951 is estimated at 285,000 tons (much below the total of the few works mentioned above). Total planned for 1955 is 450,000 tons, including a large new factory at Wolfen expected to start up in 1953, using gypsum as raw material. This is fairly plentiful in the eastern zone, although pyrites is mainly used at present. It is hoped to increase imports of this ore from Scandinavia and the Balkans.

East German Motor Fuels

SYNTHETIC fuels in Germany before the war were for the most part developed in the central and eastern zones, based on the plentiful deposits of brown coal or lignite there, among the principal works being those of the Leuna and Brabag concerns. Out of a total output during the war in central Germany, of about 1,500,000 tons, these two accounted for nearly two-thirds of it. The first-named lost about a third of its capacity through bombing, and another third through Russian dismantling, but the Russians quickly realised the importance of restoring these and other synthetic fuel factories, so that by the end of 1946 output had reached about 800,000 tons per annum. Most of the factories except Leuna are controlled by the SSAGBS (Soviet Staat Akt. Ges der Brennstoffind. Synth.). Yet another setback occurred in 1947 owing to change in Russian policy, which demanded concentration, at least temporarily, on fertiliser (nitrogen) production rather than motor fuel —although this view did not prevail for very long—and in 1948 and following years figures showed a consistent increase up to 890,000 tons in 1950, and 1,100,000 tons in 1951, almost equally divided between petrol (benzine) and Diesel oils. Nevertheless the Leuna works still has to divide its activities between these oils and nitrogen.

The second largest works in this field is SAG-Werk Tröglitz-bei-Zeitz (formerly Brabag), employing 5,000 persons. Of an annual production in 1950 of 270,000 tons, about one-third was benzine and two-thirds Diesel oil. For 1951 output was well over 300,000 tons. The former Brabag works at Böhlen-bei-Leipzig has regained and surpassed its war-time capacity with output in 1950 of 220,000 tons—mostly benzine. (*Chem. Industrie*, January 1952).

Analytical Chemists Meet

Electrographic Analysis Discussed

ELECTROGRAPHIC Analysis—a brief survey of its development with special reference to recent British apparatus, was the subject of a paper by P. R. Monk, B.Sc., A.R.C.S., A.R.I.C., read to the 35th Ordinary Meeting of the Physical Methods Group of the Society of Public Analysts and Other Analytical Chemists in London, on 19 February, with Dr. Haslam in the chair.

The electrographic method was developed independently by Glazunov and Fritz in 1929, who improved the old sulphur print of Baumann by replacing simple chemical attack by an electrolytic method. Few papers were published until the late war, when H. W. Hermance of the Bell Telephone Laboratories published his paper covering a number of metals (1940). From 1942 on, publications were fairly frequent, and in 1949 the subject achieved prominence in an A.S.T.M. Symposium on Methods for the rapid identification of metals.

By making the metal to be tested the anode in an electrolytic cell, a small quantity was transferred to the absorbent paper, or other similar material, used as carrier for the electrolyte. A piece of aluminium was now generally used as a cathode. The paper was then treated with a suitable developing agent to form a colour characteristic of the metal. This part of the work owed a great debt to Feigl, whose work on spot tests is renowned.

The method could be used for several purposes:—

(1) As a spot test for metals, alloys, or platings, to identify the constituents.

(2) Electrographic printing, showing structure and inclusions.

(3) Detecting pinholes in plated or painted coatings.

'The identification of certain alloys and stainless steels by electrographic methods,' was the subject of the other paper presented and discussed. G. C. Clark, A.R.I.C., and E. E. Hale, A.R.I.C., were joint authors.

Electrographic methods afford a means of sampling metals and alloys which can then be classified by means of spot tests employing specific reagents. Among the materials covered by this paper were copper, nickel, and their alloys, and the alloy steels in general use in industry.

HOME

Solvent Prices Decreased

A. Boake, Roberts & Co., Ltd., have announced that the selling prices of the following solvents were decreased with effect from 3 March: Butyl alcohol by £45 per ton, butyl acetate by £40 per ton, and *iso*propyl acetate by £10 per ton.

Removal Notice

The National Sulphuric Acid Association has transferred its offices as from Monday, 3 March, to: Piccadilly House, 33-37 Regent Street (Piccadilly Circus), London, S.W.1. The telephone numbers (REGent 1440 and 3561-3), also the telegraphic address (Essothre, Piccy, London), remain unchanged.

Toxic Chemicals in Agriculture

In a written answer in the House of Commons on 25 February, Sir T. Dugdale, Minister of Agriculture and Fisheries, replying to a question by Mr. E. G. Gooch, said that his attention had been drawn to the desirability of introducing legislation for dealing with the use of toxic chemicals in agriculture, but he could not state yet when this would be possible.

Practice Acquired

The executors of the late Dr. H. E. Cox, F.R.I.C., announce that the practice of Hehner and Cox, of 10 Billiter Square, London, E.C.3, has been acquired by Dr. Julius Grant F.R.I.C., as from 1 March, 1952. Dr. Grant has stated that he proposes to conduct the practice so far as possible on the same lines as hitherto, although he is, in addition, developing a department to deal specifically with paper, cellulose and allied problems.

Midlands' Society Meeting

The next meeting of the Midlands Society for Analytical Chemistry is being held on Wednesday, 12 March, at 7.0 p.m. in the Mason Theatre of the University, Edmund Street, Birmingham, when the subject under discussion will be: Some Recent Developments in Analytical Chemistry.' This will be introduced by R. Belcher, Esq., B.Sc., F.R.I.C., of the Chemistry Department of the University of Birmingham, who will give a talk on the topic followed by the usual discussion.

Distributing New Soap

Evans Medical Supplies Ltd. are now distributing a new product of their associated company, Charles Midgley Ltd., known as Medisoap No. 100. This soap contains 2 per cent hexachlorophene in a superfatted neutral base. It is presented in tablets of approximately 3 ozs.

Practice Enlarged

It has been announced that Mr. M. H. M. Arnold, B.A., B.Sc., F.R.I.C., A.M.I.Chem.E., and Mr. Cecil Hollins, B.Sc., A.R.I.C., are now associated with Dr. M. A. Phillips and Associates, the London consultants. Mr. Arnold is well-known as a specialist on fluidisation and fluid catalysis, and on applied biology.

To Address Joint Meeting

Dr. F. J. Dent, the newly appointed Director of the West Midlands Research Centre of the Gas Council, is to address a joint meeting of the Scottish Section of The Institute of Fuel and the Scottish Association of Gas Managers at 6 p.m. on Friday, 21 March, at the Royal Technical College, Glasgow. Dr. Dent will speak on 'Some Aspects of Complete Gasification of Coal,' and among those who have accepted invitations to be present are Dr. G. E. Foxwell (president, Institute of Fuel), Mr. E. G. Smith (president, Scottish Association of Gas Managers), and Mr. R. W. Reynolds-Davies (secretary, Institute of Fuel).

U.S. Scholarships for Industry

To help productivity in the U.K., 75 scholarships for study in American universities or technological institutes are being awarded by the Mutual Security Agency (formerly ECA). Of these awards 35 will be for the study of production technology combined with management, and, normally tenable for one year, will be open to students who hold good honours degrees in either pure science or technology, who have had at least two years' industrial experience, and who are now working in industry or research associations or are teaching in universities or technical colleges. Closing date for applications is 16 April. Successful candidates will leave for the U.S.A. early in September.

· PERSONAL ·

The president of the British Association of Chemists, MR. C. A. WYLIE (chairman of the Liver Grease, Oil & Chemical Co., Ltd., of Liverpool), who is at present on a visit to South Africa, was recently entertained to luncheon in Port Elizabeth by members of the Association residing in the district. The president of the South African Chemical Institute was also a member of the party.

The council of the Chemical Society has awarded the Corday-Morgan medal and prize for 1950 to DR. R. S. NYHOLM in recognition of his outstanding experimental work on co-ordination compounds, with special reference to his discovery of tervalent nickel complexes.

MR. W. ARMFIELD, A.M.C.T., A.T.I., senior analyst and research chemist at Courtaulds, Ltd., Droylesden, has been elected a Fellow of the Textile Institute. Mr. Armfield has been responsible for substantial contributions to the theory of dyeing and its interpretation for the working technologist. He has carried out research work on chemical modification of fibres and on dyeing technology, and has taken out patents and published several papers concerned with dyeing research.

An honorary associateship of the College of Technology, Birmingham, has been conferred upon DR. DONALD PARKINSON, F.Inst.P., of Dunlop's compounding research division.

DR. W. E. DE B. DIAMOND, formerly general manager of the British Plastics Federation, has been appointed director and secretary. MR. C. J. G. STANLEY is now manager—at present in the United States as secretary of the Productivity Team for the Moulding Branch of the Industry.

MR. L. E. MEEKS and MR. H. R. WALTON, B.Sc., both previously directors of Electroflo Meters Co., Ltd., have recently joined Elliott Brothers (London) Ltd., the well-known makers of process control equipment, Fisher Governor specialities for automatic control and electrical measuring instruments.

Recent passengers by B.O.A.C. Stratocruiser service to Montreal were Dr. Melhuish (left), Deputy Manager, Plastics Division, I.C.I.; Mr. W. F. Lutyens, Managing Director of I.C.I. and Dr. A. Caress, Director, Plastics Division, I.C.I. They are seen here before their departure at the B.O.A.C. ticket desk, London Airport

Obituary

We regretfully announce that the death of MR. RALPH WILDERS JOHNSON, a director of Carty & Son, Ltd., took place on 26 February after a long illness. Mr. Johnson, who was a nephew of the late Mr. Robert S. Johnson, joined the firm in 1925, and had been a director since 1937.

The death has occurred in a Middlesbrough hospital of MR. LIONEL FREDERICK KNAPP, general works manager at I.C.I. Wilton. He was 56. Mr. Knapp was manager of the oil division at the I.C.I. at Billingham, from 1933 until 1942, when he became general manager at I.C.I. at Heysham, where he stayed until 1946. Returning to Billingham, he became oil technical manager until he went to Wilton in 1947.

OVERSEAS

First of its Kind

Companhia Química Rhodia Brasileira, a large producer in the chemical field, will shortly conclude the erection of a new synthetic ammonia plant, the first of its kind in Brazil. The product will be marketed in the compressed and liquid state, as well as in a 24-25 per cent solution.

Industrial Waste Conference

The seventh Purdue Industrial Waste Conference will be held on 7, 8 and 9 May, 1952. The meetings will be held in the Purdue Memorial Union, Purdue University, Lafayette, Indiana. There will be approximately fifty papers presented on subjects dealing with industrial wastes and their treatment. Everyone is welcome. The registration fee will not exceed $10.

Oxygen Plant Started

The French company 'Air Liquide' has begun the operation of an oxygen plant at Pointe Noire, in the Belgian Congo. Other plants of this nature already exist at Dakar and Leopoldville, but the shipping costs from them were excessive. The Pointe Noire plant will be large enough to look after all requirements in French Equatorial Africa. It is planned also to make liquid acetylene and carbonic gas at Pointe Noire.

Canadian Chemical Projects

Present and future developments in Canadian chemical industry were outlined by the president of the Canadian Chamber of Commerce, recently, in a speech before the Quebec Board of Trade. Railroads were being built, he said, for exploiting the iron ore in Ungava and the copper ore at Lynn Lake, Manitoba, and a whole city was being built for uranium miners at Beaver Lodge Lake in North Saskatchewan. The Aluminium Company of Canada, Ltd., was spending $160,000,000 at Kitimat, B.C., as the first step in a $500,000,000 project. The pipeline from Alberta to the Great Lakes was now a reality, and a refinery would be needed for the zinc discovered in Barraute, in north-western Quebec. Lake Allard titanium in north-eastern Quebec meant electro-metallurgy processing at Sorel, Quebec.

U.S. Aluminium Plants

Reynolds Metals Company, Richmond, Va., are to construct a new aluminium reduction plant with an annual capacity of 110,000,000 lb. and costing $30,000,000, at Gum Springs, Ark., it is reported. It is expected to be in production by the first half of 1953, and will use the Soderburg process. The firm is building another aluminium plant with a capacity of 160,000,000 lb. at Corpus Christi, Texas.

New Refining Plants

A plant for refining oils by the new Solexol method is being built at Fredrikstad, Norway, by the De-No-Fa oil refining company. New plant has also been installed at Norway's other major marine oil refining factory, Sandar Fabrikker, Sandefjord. A large new fatty acids plant has been built at a cost of over £400,000 for refining up to 10,000 tons of raw oil a year.

New Coenzyme A Extraction Process

Chemists of the University of Wisconsin, U.S.A., are recently reported to have evolved a new technique for the isolation of coenzyme A—coenzyme common to all living tissue—from brewer's yeast. Up to now the coenzyme has been available only in amounts of the order of .001 g. Pantothenic acid, one of the vitamin B complex, is known to be part of it. Wisconsin workers have sent gifts of the enzyme to principal laboratories in America, and arrangements have been made with a brewing company to produce relatively large quantities.

Aluminium Piping

Irrigation tubing made from aluminium, although about one-third dearer than galvanised iron tubing, is proving popular with many farmers in Australia because it is so easily transported, and is not subject to rust and corrosion in the soil. A company in Sydney, New South Wales, markets the tubing in lengths of 24 feet, with special spray units. These units are hemispherically shaped, and are fitted to the tubing with a specially developed socket, locking and rubber ring. Each unit is designed to throw a constant spray over an area of 48 square feet.

The Chemist's Bookshelf

PROGRESS IN ORGANIC CHEMISTRY. Edited by J. W. Cook. Butterworth's Scientific Publications, London. 1952. Pp. 287. 50s.

There has for a long time been a need for a 'Readers' Digest' type of publication dealing with the field of organic chemistry. The ever increasing volume of papers published becomes a nightmare to the research worker or departmental chief forced to read many directory-size research journals, trade journals and scientific books monthly. If their interests cover a wide field they are even more unfortunate, for they must record pertinent material at the time of reading, or else face a literature search at a later date. Strangely enough the publication of review journals and abstract journals seems to add to the load rather than diminish it, and a useful index to the extent of the problem is indicated by the size of library staffs of relatively quite small research organisations. All such people then, cannot fail to applaud this new venture which will provide authoritative but readable articles upon recent trends in organic chemistry. It is to be stated at once that their best hopes are fully realised in this first volume, and no organisation connected with organic or biochemistry should fail to acquire a copy.

The editor, himself a noted professor, has collected together eight articles, each one written by an expert and an active worker in the field which he reviews. Together they form an excellent cross-section of contemporary organic chemistry from its boundary with biochemistry (with the elucidation of structure of natural products and the determination of their biological significance) through the fields of preparative and industrial chemistry to the boundary with physical chemistry in the examination of reaction mechanisms. Professor Cook is to be congratulated upon his selection of topics which display just the right proportion of topicality and general interest.

The first article has been contributed by Sir Robert Robinson upon the 'Molecular Structure of Strychnine, Brucine and Vomicine', a subject with which his name has been connected for so many years. The story of the unravelling of the structure of that most complex alkaloid, strychnine, a process to which the author has made a considerable contribution, is fully but economically told. The recent successful solution of the problem makes this section apposite and complete.

The volume has an international character and the next contribution is from Professor H. Erdtmann, of Stockholm. The title of his article 'The Chemistry of Some Heartwood Constituents of Conifers and their Physiological and Taxonomic Significance' is self-explanatory, but its casual nature gives no indication of the exhaustive character of the exposition. The material is arranged under the natural orders of the trees themselves, and this method of arrangement clearly brings out the relationships between structure and type. In particular the discussion upon the chemistry and constitution of the thujaplicins and their relation to the true terpenes is to be recommended.

The third article also comes from outside this country. Professor H. H. Brockmann, of Göttingen, is responsible for the review entitled 'Photodynamically Active Natural Pigments', which is largely concerned with the active principle of St. John's Wort, hypericin. This is probably one of the most readable sections of the book, largely because it has unity of subject, and focuses our attention upon an effect which has not had a great deal of publicity in this country. The section upon the biosynthesis of hypericin is perhaps a little too speculative, but this is a minor point and need not be stressed.

The two most important influences in acetylene chemistry in the last decade have been the team of workers under the leadership of E. R. H. Jones, at Imperial College, and that led by Reppe in Germany during

the last war. There have been many attempts to incorporate the work of both these schools in reviews of acetylene chemistry, but this article by B. C. L. Weedon entitled 'Acetylene Chemistry' is by far the best the reviewer has encountered.

For such a diverse and confusing subject it is surprisingly complete and authoritative without ever descending into a list of formulae and cookery hints. Of almost equal standard in their way are 'The Review of Chemicals from Petroleum' submitted by S. F. Birch, and the long and detailed survey entitled 'Drugs Inhibiting Symptomatic Stimulators' written by E. Bergel and M. W. Parkes, both from the large pharmaceutical organisation, Roche Products.

The penultimate section 'Free Radicles as Intermediates in Organic Reactions' has been contributed by Professor Hey who must be considered as the foremost authority upon what might be termed instantaneous chemistry. This is an article which will be of immense value to students, and university examiners must look forward to marking large numbers of more or less garbled versions of these pages.

The last contribution by Professor Preece upon 'Starch and its Products of Amylotic Degradation' may have a more limited appeal, but is as complete and satisfying as its predecessors.

Let us hope that it will not be too long before the publishers produce a successor to the present volume.—J.R.M.

CHEMISTRY OF CARBON COMPOUNDS. Vol. I. Part A. Edited by E. H. Rodd. Elsevier Publishing Company, Amsterdam, etc. Distributed by Cleaver-Hume Press, Ltd., London. 1951. Pp. 777. £7.

In his arduous task of editing 'Chemistry of Carbon Compounds' Dr. Rodd has been assisted by a team of eminent advisors (Professors J. W. Cook, R. D. Haworth, Sir Ian Heilbron, E. L. Hirst and A. R. Todd), under the chairmanship of Professor Sir Robert Robinson. Their objective, which so far has been achieved in an admirable fashion, has been to fill the need for an up-to-date systematic book, intermediate in size between the great Encyclopaedias, such as 'Beilstein' and 'Elsevier', and the shorter works suitable as text-books for undergraduates. The new series will, in fact, be a modernised version of 'Richter', built largely on the original framework, and with each section written by an expert in that particular field. It has been designed for those who have a working knowledge of the principles of both organic chemistry and physical chemistry.

The character of the first volume can be judged from the fact that it has been necessary to include a list of abbreviations for the titles of some 150 journals. This list is by no means superfluous, for references to original papers are to be found in abundance in the text.

The general introduction presents a background to the theoretical and physical problems which are to follow; in its 220 pages it contains articles on the history, classification, nomenclature and documentation of organic chemistry (E. H. Rodd), microanalytical methods and techniques (R. Belcher), physical properties of carbon compounds (H. D. Springall), crystallography (A. F. Wells), spectra (E. A. Braude), acids and bases (H. D. Springall), stereochemistry (E. E. Turner), reaction mechanisms (E. D. Hughes) and homolytic reactions (D. D. Hey and W. A. Waters).

The same high standard is maintained in the second part of the book, which is devoted to the chemistry of aliphatic compounds. It contains a wealth of information presented in a clear and concise manner; the system of numbering methods of preparation, properties, etc., is an aid in locating any desired data. The order of the groups is determined according to a logical plan, but it is not always obvious, without the aid of the very extensive index, where a given compound is to be found; for example, chloroform is discussed in the chapter dealing with monobasic carboxylic acids.

If this first volume is a foretaste of the delicacies which are to grace future volumes, then there is no doubt whatsoever that the series will be of great value to anyone who pursues his course in the fields of organic chemistry. It is attractively bound, well printed and liberally equipped with cross-references and should do much to advance the prestige of British chemists. The reviewer hesitates to offer even a minor criticism of such a fine work, but he would have liked to have seen the reaction mechanisms more closely interwoven with the classical reactions.—E.J.B.

Publications & Announcements

USES for aluminium are described in *The Aluminium Courier*, for December, 1951, published by The Aluminium Development Association, of 33 Grosvenor Street, London, W.1. The versatility of this metal is already well-known, and some of the multifarious uses to which it is put—described in the *Courier*—are in the packaging of butter, cheese, tea; as containers for detergents, toothpaste, lubricating oil, fish, vegetables and radio valves; as covers and caps for a variety of containers, and as aluminium foil in the manufacture of milk bottle caps (annual consumption for this purpose is over 5,000 tons), for tea chest linings, food wrappers, etc. The *Courier* is available from the Association (price 5s.).

* * *

FOLLOWING the successful introduction of their Pipe Welding and Pipe Welding (Molybdenum Bearing) electrodes, the Quasi-Arc Company, Ltd., of Bilston, Staffordshire, have now issued an 8-page technical circular giving details of the mechanical properties and chemical composition, welding technique, deposition and packing data, as well the applications and characteristics of the electrode. Copies of this new technical circular can be obtained from the Quasi-Arc Co., Ltd., at the above address.

* * *

RECENTLY published by the Royal Society for the Prevention of Accidents is a guide to the principal safety requirements of the Factories Acts, 1937 and 1948. This guide has been designed for the use of factory managers, engineers, factory management staff, supervisory grades, labour departments, legal departments and others concerned with management, safety and the welfare of workers, to enable them to check their responsibilities under the Factories Acts and the Regulations made under them. The book fills an important gap and its 90 pages will enable anyone to find a quick answer to any problem they may have concerning factory safety legislation. It contains fifteen sections, all items being indexed and cross-indexed in what must be the only full index to some of the complexities of the Factories Acts and the many Statutory Instruments which are legal requirements under these Acts. It does not pretend to be a legal guide; no attempt is made to interpret the requirements or to give advice on fulfilling them. It gives the facts, i.e., definitions, direct requirements, exceptions and exemptions, and lists under each section the full title and number of the Statutory Instruments concerned. Each page has marginal reference to the sections and sub-sections of the Acts involved, the numbers of the legal forms to be used and the Statutory Instrument related to the context of the paragraph. The guide is recommended as a standard work of reference. It is obtainable from the Society at 52, Grosvenor Gardens, London, price 15s.

* * *

THE official opening of new premises at Chadwell Heath on 8 May 1951 is one of the subjects covered in the latest issue of the Baird and Tatlock Bulletin, which is a review of 1951. Photographs of the firm's new laboratories are shown, and an account of the Physical Society's exhibition in April given. Also shown are descriptions and photographs of various newly designed instruments and products of the firm. Particularly interesting is an account of the use of synthetic resin laminates as materials for the bases, stands and supports of physical apparatus. These laminates have been found to be superior to the natural hardwood previously used. A short article on the Polaritan reagents of Hopkin and Williams and a review of the 1951 British Instrument Industries Exhibition are also included.

* * *

A DETAILED information booklet on the safe handling of sodium chlorate has been issued by the American Manufacturing Chemists' Association, Inc. Emphasis is placed upon the known hazards of sodium chlorate and its potentially explosive characteristics when in contact with phosphorus, sulphur, powdered metals and other substances. Shipping methods and regulations to be followed in all phases of handling are discussed and employee education and training, personal protective equipment, and first aid are covered. Chemical Safety Data Sheet SD-42, 'Sodium Chlorate,' may be purchased at 25c. a copy from the Manufacturing Chemists' Association, Inc., Woodward Building, 15th and H Streets, Washington 5, D.C.

LIMITATIONS previously experienced with ordinary red lead as primer under certain conditions are claimed to have been overcome by Evode, Ltd., of Stafford, which has a high reputation for innovations in waterproofing, with its new type of red lead primer 'Evo-led'. This is said to be suitable for application to damp or even wet surfaces and is non-lifting or bleeding after 24-48 hrs., even when overpainted with paints containing searching solvents. 'Evo-led' displaces moisture on any surface and allows it to evaporate together with the solvents during the drying process, resulting, it is claimed, in a perfect bond. One gallon of the new primer is sufficient to cover a surface of 35 to 50 sq. yds.

* * *

A PATENT automatic gas washer produced by the Kestner Evaporator and Engineering Company, Ltd., is a self-contained unit for producing intimate contact between gases and liquids, for use in gas washing, acid fume and dust removal, suppression of objectionable odours, and for a wide range of chemical and manufacturing processes. The principle of the washer is a Venturi tube which, by an impeller at its top, draws up gas and scrubbing liquid together, mixing them intimately, recirculating them if necessary. Advantages claimed for the washer are its compactness, the fact that there is only one moving part—the impeller—which is the only source of energy required, its continuity of operation, and its low power and running costs. Sight glasses enable the operation to be seen, and solids in the liquid or gas can be tolerated either in suspension or as sediment. The plant is available in a range of materials including mild and stainless steel, copper, aluminium, lead, Keebush, etc.

* * *

A COMPLETE guide to the Building (Safety, Health and Welfare) Regulations, and Statutory Instrument, 1948, No. 1145, has been published by the Royal Society for the Prevention of Accidents. This Guide is recommended as a standard work for ready reference to all concerned with building construction, not only those actively engaged on the actual building task, but architects, engineers, and others concerned first with design and later with supervision or consultancy. It should be especially useful to the safety advisers who now have to be appointed under the Regulations. Statutory Instrument No. 1145 applies to building operations undertaken by way of trade or business or for the purpose of any industrial or commercial undertaking, or by or on behalf of the Crown or any municipal or other public authority. These Regulations have possibly the widest application in general industry of any made under the Factories Acts, and this book is a successful attempt to provide a simple, but complete guide for those who have to comply with them. The authors have grouped the relevant requirements under appropriate headings, and have compiled a comprehensive index. The main sections of the Guide covered are dates of operation; Regulations revoked; definitions of terms; application of the Regulations and Factories Acts; obligations under the Regulations; appointments and personnel; examination, tests and records; notices, signs or marks; first aid; welfare and personal safety appliances; scaffolds, working places and access; excavation; demolition of buildings; chains, ropes and lifting gear; lifting appliances; hoists, machinery; and general precautions. The guide may be obtained from the Society at 52 Grosvenor Gardens, London, S.W.1, price 15s. post free.

* * *

PRECAUTIONS to minimise explosion hazards when handling or processing dusts or powders of titanium, zirconium, thorium, uranium and their hydrides, are outlined in a report recently published by the Bureau of Mines, United States Department of the Interior. The report, made in collaboration with the Atomic Energy Commission, is based on investigations of the behaviour of 22 powder samples at various temperatures in air and in other gaseous atmospheres. Recommendation is made that wherever possible the manufacturing operations involving the more hazardous powders should be performed in atmospheres of helium or argon, while particulars are also given of vent requirements in buildings where dust explosions are liable to occur. A free copy of Report of Investigations 4835, 'The Explosive Characteristics of Titanium, Zirconium, Thorium, Uranium and their Hydrides', may be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Increases of Capital

The following increases of capital have been announced: X. GRAEESER SALICYLATES LTD., from £25,000 to £75,000; BRITISH CHLOROPHYLL CO., LTD., from £100 to £15,000; SEVILLE SULPHUR & COPPER CO., LTD. from £120,000 to £220,000.

New Registrations

General Chemical Products (Lemerit), Ltd.
Private company. (504,481). Capital £100. Director: Simon Davis. Reg. office: 18 Maddox Street, W.1.

B.O.P. Fertilisers, Ltd.
Private company. (504,548). Capital £3,000. Manufacturers of organic manures and fertilisers, etc. Directors: L. A. Bremner and H. A. S. Gothard. Reg. office: 141, Moorgate, E.C.2.

Charles Geddes (Paignton), Ltd.
Private company. (504,597). Capital £1,500. Consulting analytical manufacturing, pharmaceutical and general chemists. Directors: B. H. Geddes, E. M. Golding, V. Grant and A. Driver. Reg. office: 39 and 40 Fleet Street, Torquay.

H. Tiffin & Son (Bournemouth), Ltd.
Private company. (504,850). Capital £3,000. Manufacturers of insecticides. Directors: F. V. Tiffin, and W. G. Barton. Reg. office: 37 St. George Street, W.1.

Briggs & Townsend, Ltd.
Private company. (504,833). Capital £10,000. Manufacturers of chemicals. Directors: J. H. L. Briggs, and L. W. E. Townsend. Reg. office: 4 Commercial Street, Knott Mill, Manchester, 15.

B. W. E. Beard, Ltd.
Private company. (504,834). Capital £10,000. Manufacturers of chemicals, gases, drugs, medicines, etc. Directors: E. Beard, H. F. Beard and H. J. Eeles. Reg. office. 33-4 Chancery Lane, W.C.2.

J. D. Campbell and Sons, Ltd.
Private company. (504,794). Capital £15,000. Manufacturing, research and analytical chemists. Directors: J. D. Campbell, R. D. Campbell. Reg. office: 4 Lund Street, Cornbrook, Manchester, 16.

Company News

Redfern's Rubber Works, Ltd.
Profit of Redfern's Rubber Works, Ltd., for the year ended 31 December, 1951, with a value of £137,719 was the highest on record. The directors recommend a final ordinary dividend of 5 per cent, making 10 per cent for the year, plus a bonus of 10 per cent, making a total of 20 per cent. This compares with a distribution of 17½ per cent for the years 1947 and 1948, which was reduced to 15 per cent for 1949 and 1950. Major expenditures during the year were for a new building and primary plant.

Anchor Chemical Co., Ltd.
The report for the year ended 30 November, 1951, of the Anchor Chemical Co., Ltd., Clayton, Manchester, shows consolidated current assets £693,087 (£491,571); current liabilities £320,666 (£188,318); revenue reserves £167,216 (£118,133). The meeting will be held at 2.30 p.m. on 21 March. Mr. T. H. Hewlett is chairman.

African Explosives & Chemical Industries, Ltd.
Consolidated manufacturing and trading profits of African Explosive & Chemical Industries, Ltd., in the 12 months ended 30 September, 1951, totalled £2,658,211 compared with £2,146,081 in the previous year. Profit after tax was £1,226,334 (£922,387). In its report the directors state that owing to the expansion of the company's activities and to the additional projects on which it is intended to embark, new capital requirements are considerably in excess of the £4,000,000 which ordinary shareholders agreed to provide by way of loans a year ago. It has therefore been decided to liquidate those loans by the issue of ordinary shares at 32s. per share. Additional funds will be raised by means of Note issue. Meeting will be in Johannesburg on 18 March. Chairman is Sir Ernest Oppenheimer.

British Metal Corporation (Central Africa)
Operations have now been begun by the British Metal Corporation (Central Africa), from its temporary headquarters in Bulawayo. The company, which will deal particularly with non-ferrous metals and ores, has an authorised capital of £10,000. It is a wholly-owned subsidiary of the British Metal Corporation, London.

Next Week's Events

MONDAY 10 MARCH

Society of Chemical Industry

Leeds: University, Woodhouse Lane, 6.30 p.m. Annual general meeting, of Leeds Section. 7.0 p.m. Dr. E. V. Truter: 'The Use of Urea Complexes in the Study of Wool Wax'; Dr. R. W. Grimshaw: 'The Constitution and Related Properties of Fireclays.'

Institute of Metals

Glasgow: 39 Elmbank Avenue, 6.30 p.m. Scottish Local Section, annual general meeting. Dr. J. Chaston: 'Joining Metals.'

Institute of Chemical Engineers

Birmingham: University, Edmund Street, 6.30 p.m. Graduates' and Students' Section, Midland Centre. W. N. Hoyte: 'The Good Life for a Chemical Engineer.'

TUESDAY 11 MARCH

Royal Institute of Chemistry

Wigan: Mining and Technical College, 7.0 p.m. Liverpool and N. Western Section. J. H. Shulman: 'Hydrogenation—Theory and Practice.'

Institution of Chemical Engineers

London: Burlington House, Piccadilly, W.1, 5.30 p.m., with the Low Temperature Group of the Physical Society. Dr. M. Ruhemann: 'The Control of Low Temperature Gas Separation Plants.'

Institute of Metals

Oxford: 7.0 p.m. Professor C. S. Barrett: 'Transformations in Metals.'

WEDNESDAY 12 MARCH

Society of Chemical Industry

Nutfield, Surrey: Brewing Industry Research Foundation. Joint meeting of the Food Group with the London Section of the Institute of Brewing. 'The Chemistry of Hops.' 11.30 a.m. Informal tour of research foundation; 3.0 p.m. Scientific meeting session I: Dr. A. H. Burgess: 'The Chemical Aspects of Hop Culture'; A. R. Tatchell: 'The Chemistry of Hops as Prepared for the Market.' 5.15 p.m. session II: Dr. G. A. Howard: 'The More Detailed Chemistry of Hop Constituents.'

Chemical Engineering Group (SCI)

Liverpool: University, 7.0 p.m., with the Oils and Fats Group, SCI. M. K. Schwitzer: 'Continuous Processes in the Oil Production Industry.'

Society of Leather Trade Chemists

Manchester: Engineers' Club, Albert Square, 2.0 p.m. (Papers to be announced).

THURSDAY 13 MARCH

The Chemical Society

London: Burlington House, Piccadilly, W.1, 7.30 p.m. Reading of Original Papers.

Nottingham: University, 4.45 p.m., with Nottingham University Chemical Society. Professor S. Peat: 'Starch Metabolism in the Higher Plants.'

Plymouth: Technical College, Tavistock Road, 5.30 p.m. Joint meeting with RIC and SCI. Dr. H. F. P. Herdman: 'Some Aspects of Physical Oceanography in Antarctic and Sub-Antarctic Waters.'

Royal Institute of Chemistry

Reading: University, 8.15 p.m., with Reading University Chemical Society. Dr. F. Sherwood Taylor: 'Some Aspects of the History of Science.'

The Royal Society

London: Burlington House, Piccadilly, W.1, 10.30 a.m. N. F. Mott will open a discussion on: 'The Physics of the Liquid State.'

British Ceramic Society

Sheffield: University, Mappin Street, St. George's Square, 9.30 a.m. Spring meeting of the Building Materials Section. Discussion on: 'Soluble Salts in Bricks and Brickwork.' 2.0 p.m. Visit to works of the Sheffield Brick Company, Ltd., Neepsend.

FRIDAY 14 MARCH

The Chemical Society

Birmingham: University, Edgbaston, 4.30 p.m., with Birmingham University Chemical Society. Professor F. S. Dainton: 'The Formation of Hydrogen Atoms in Aqueous Solution.'

Swansea: University College, 5.30 p.m. Joint meeting with RIC and University College of Swansea Chemical Society. Dr. U. R. Evans: 'The Combination of Metals and Non-metals.'

Society of Chemical Industry

London: 4 Grosvenor Gardens, S.W.1, 10.0 a.m.-1.0 p.m. and 2.30-4.30 p.m. Joint meeting of the Corrosion Group with the

[continued on page 396

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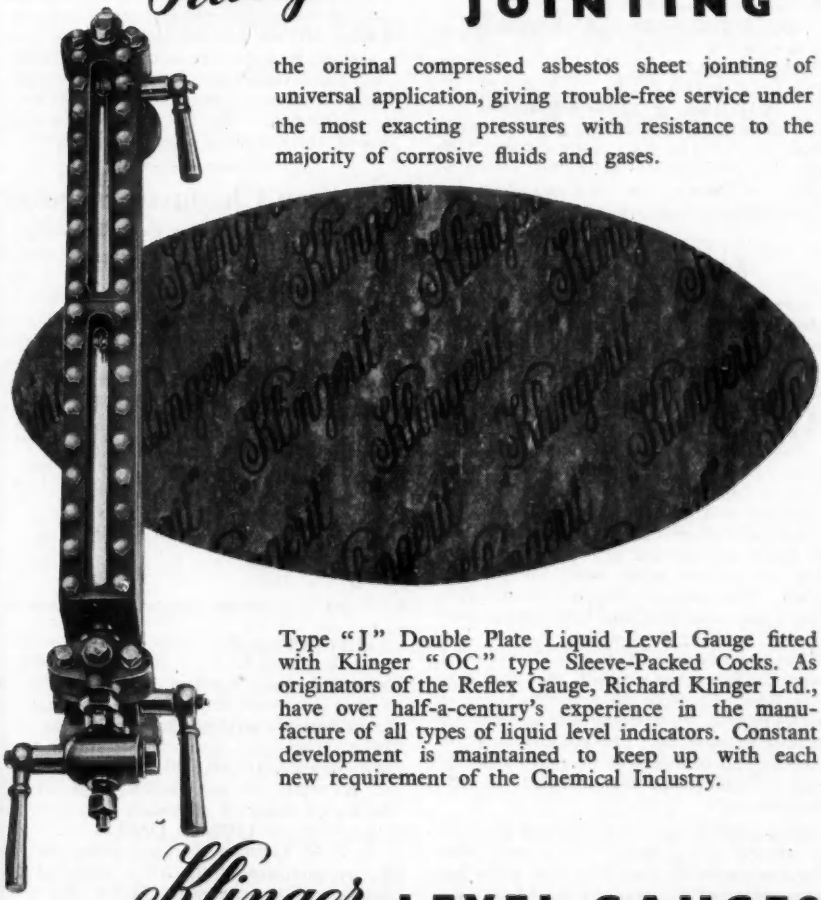
the original compressed asbestos sheet jointing of universal application, giving trouble-free service under the most exacting pressures with resistance to the majority of corrosive fluids and gases.



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Next Week's Events

continued from page 394

Association Belge pour l'Etude, l'Essai et l'Emploi des Matériaux. Papers on: 'Protective Coatings under Conditions of Atmospheric Corrosion.'

Oil & Colour Chemists' Association

Manchester: Grand Hotel, 2.30 p.m. T. Sonsthagen and J. A. Chance: 'The High Pressure Bar Mill.'

Association of Applied Biologists

London: Imperial College, Prince Consort Road, S.W.7, 11.0 a.m. Joint meeting with the Crop Protection Panel of the Society of Chemical Industry. Papers and discussion on 'Herbicides and Systemic Fungicides.'

Market Reports

LONDON.—The industrial chemicals market has been without any special feature and business during the past week has been maintained at a moderate level. Home consumers are calling for routine deliveries against contracts and there has been a fair weight of inquiry for export.

Following the recent reduction in the price of lead, lower quotations have been notified for lead acetate and lead nitrate. The former is now quoted at £189 10s. per ton and the latter at £150 10s. per ton. Cream of tartar and tartaric acid have also been reduced, the new prices being 20s. per cwt. lower. The seasonal interest in fertilisers is developing and there has been rather more inquiry for chloride of soda.

The price position of most of the coal tar products is unchanged with the undertone very firm. Creosote oil continues to be in active request, while supplies of pyridine are difficult to come by. The home demand for cresylic acid continues to be active and supplies of naphthalene are inadequate to meet the demand.

MANCHESTER.—Prices have reacted slightly in one or two instances in sympathy with the raw materials, but otherwise there has been sustained firmness on the Manchester chemical market during the past week. Textile chemicals are still in somewhat reduced demand compared with the experience a month or two ago. In other directions, however, home consumers of the alkalis and other bread-and-butter lines are taking steady deliveries under contracts and a fair amount of replacement buying has been reported during the past few days. Export business is also on a satisfactory scale. The demand for fertilisers is described as fair.

GLASGOW.—Little change in conditions is reported with demand from some of the major consuming trades still spasmodic and far below expectations. However, it is anticipated that the next fortnight or so will see a change in some directions for the better. The price reductions for various solvents and plasticisers to come into effect next week are welcomed. As far as export is concerned, there is little change to report.

German Chemical Exports

Latin American Market Being Expanded

GERMAN manufacturers have always realised the importance of the Latin American market, especially for chemicals. In 1937 chemical exports totalled 115,400,000 RM ($46,200,000). In 1950 from Western Germany only, the figure was 93,600,000 DM ($22,300,000). Details for the different countries are as follows (in 1,000 RM/DM):

	All Germany	*W. Germany*	
	1937	1950	*First Half* 1951
Mexico ..	16,500	6,994	7,900
Argentine	21,400	23,294	31,914
Brazil ..	29,700	21,365	22,115
Chile ..	10,500	6,499	7,100
Columbia	9,600	9,578	13,500
Ecuador ..	1,700	1,111	1,000
Peru ..	6,600	3,975	3,863
Uruguay	3,400	8,134	5,400
Others	16,000	8,352	—
	115,400 RM	93,620 DM	105,000 DM

In comparing 1937 with 1950, allowance must of course be made for the greatly increased values (prices) in 1950. Incidentally it may be mentioned that U.S. exports to Latin America in 1950 totalled $295,136,000. Swiss exports, too, were considerable in that year, namely, 117,700,000 Swiss francs, out of a total of 601,000,000, and Great Britain's exports of chemicals amounted to £11,200,000 (131,000,000 DM.).

In Brazil German firms are taking part in the development of the home chemical industry. For example, Firma Dr. C. Schleussner Fotowerke G.m.b.H. has submitted to the Brazilian Commission for Industrial Development a scheme for erecting a factory for the manufacture of photochemicals in Brazil, using local raw material, and of sufficient capacity to begin with to supply half the home market requirements.

B.D.H.

Micro-Analytical Reagents

'M.A.R.'

As from the 1st November, 1951, the micro-analytical reagents issued by The British Drug Houses Ltd. to which the designation 'M.A.R.' is applied will conform to new quantitative specifications which have been published separately. These revised and more exacting specifications have been approved by the Microchemistry Group of the Society of Public Analysts and other Analytical Chemists, with whose advice and assistance they were prepared

Each package of the new 'M.A.R.' reagents carries the specification on the label. An eight-page booklet giving the specifications in full may be obtained free on request.

THE BRITISH DRUG HOUSES LTD.
B.D.H. LABORATORY CHEMICALS GROUP
POOLE **DORSET**

Telephone: Poole 962 (6 lines)
Telegrams: Tetradome Poole

MAR/1

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

ANALYST required for the Chemical Laboratory of a large Light Engineering Works in the West London area. Duties will include work on electro-plating, enamelling and general process control. Degree standard required. Commencing salary, £600 to £700, according to age, qualifications and experience. Write, giving details, to **BOX NO. C.A. 3119,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

A VACANCY has occurred in our Works Control Section for a Young Graduate Chemical Engineer or Chemist. The post is one of responsibility and requires a considerable degree of initiative. Write, giving all particulars and stating salary required, to **BRITISH ACHESON ELECTRODES, LTD., GRANGE MILL LANE, WINCOBANK, SHEFFIELD, 9.** This is a professional appointment and does not need Ministry of Labour permission.

BIRLEC LIMITED, TYBURN ROAD, BIRMINGHAM, 24, offer **EXECUTIVE POSITION** in their Dryer Division with special responsibility for sales in chemical engineering and air conditioning fields to man of energy and vision. Must be capable of developing self-contained department for important new industrial equipment. Position is potentially one of authority and wide scope, requiring first-class ability and sound appreciation of management problems. Apply in writing to **PERSONNEL OFFICER.**

CHEMICAL ENGINEER (age 25-30) is required for manufacturing works in Nairobi, East Africa. Science Graduate and A.M.I.Chem.E. necessary. To assist General Manager in operation of plant producing edible oils, sulphuric acid and caustic soda. Also to assist in development work. Applicants preferred who have had engineering shops' experience, and not less than three years' industrial experience after being qualified. Tour, four years. Accommodation provided at nominal rent, passages paid.

Please apply, in writing, stating age, qualifications, and experience, to **PERSONNEL, COLONIAL DEVELOPMENT CORPORATION, 33, DOVER STREET, W.1,** quoting Serial No. 98, by March 18th, 1952.

CHEMICAL ENGINEER. THE MIDLAND TAR DISTILLERS, LTD., OLDBURY, NEAR BIRMINGHAM, require a fully qualified Chemical Engineer with several years' experience in industry. An ability to apply sound knowledge and experience in the design and development of new chemical projects is of the first importance. Age 27-35. Good salary offered according to age and experience, etc. Contributory pensions scheme in operation. Applications, with full particulars, to PERSONNEL MANAGER.

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600

TORRANCE Micro Twin Granite Roll **REFINING MILL,** 20 in. by 14 in. by 12 in. Oscillating adjustable back roll. Fast and loose pulley drive.

Three Micro Twin **REFINING MILLS,** by Torrance. Rolls, 14 in. by 9 in. by 7 in. Drive from fast and loose pulleys.

Twin Steel Roll **REFINING MILL,** by Marchant, 24 in. by 12 in., driven from fast and loose pulleys.

Battery of six 20 in. diam. **CONE MILLS,** mounted on R.S.J's. Each **MILL** with jacketed hopper with 22 in. diam. mouth. Hand wheel adjustment to cones. Drive through gear-driven main shaft on sliding bevel give independent control to each mill.

ROTARY DRYER by Johnson, 40 ft. by 6 ft. diam. Motorised 24 h.p., 400/3/50, 950 r.p.m. With furnace steelwork and extraction fan.

Two Steam-jacketed **ROTARY VACUUM DRYERS,** each 17 ft. 3 in. by 4 ft. 6 in. diam. Manhole in barrel with cover. Mounted on roller tracks and driven through glanded trunnion bearings. Discharge through S.J. chamber.

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CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal-insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. **HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH, LONDON," TELPHONE 3285 EAST.**

GRAVITY Roller Conveyor several lengths, Rolls. 2½ in. diam. by 16 in. 3 in. centres. Good condition. **THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET, MILLWALL, E.14.** (Tel. . East 1844.)

FILM DRUM DRYER, steam-heated drum, 4 ft. diam. by 6 ft. long, complete with doctors, etc. Steam-jacketed **WORM DRYER,** comprising three jacketed cylinders, each 2 ft. diam. by 16 ft. long, fitted heavy type **WORM CONVEYORS. LITHCOATE LINED TANK,** 4 ft. 6 in. diam. by 13 ft. long. **ACID PUMP,** 2 in. inlet, 1½ in. outlet, made of Havag (a German plastic), about 40 gals. per minute up to 60 ft. head. Jacketed **VACUUM DRYERS,** 3 ft. diam. by 7 ft. long, with run-out trolley. Beken 50-gal. stainless steel **TIPPING MIXER. WERNER MIXERS,** jacketed, 28 in. by 28 in. by 28 in., with double fin blades. **WERNER MIXER,** not jacketed, 29 in. by 29 in. by 29 in. double "Z" blades. **BUHLER 4-ROLL MILL,** jacketed rolls 30 in. by 12 in. Few stainless steel **PUMPS,** jacketed **POT** and **CONTAINERS. DARTNALL, 248, HUMBERSTONE ROAD, PLAISTOW, LONDON, E.13.**

MONOCHLORONAPHTHALENE (REFINED GRADE) IN 5-GALLON GALVANISED DRUMS. IMMEDIATE DELIVERY OF UP TO 42 TONS MUCH BELOW MARKET PRICE. Apply **BOX No. C.A. 3117,** THE CHEMICAL AGE, 154, Fleet Street London, E.C.4.

OERTLING aperiodic (air damped) prismatic reflecting balance. 100 gm. capacity—sensitivity: 0.1 milligram. Complete with transformer (230 V, 50 C.). Whole in excellent condition. £50. Apply **BOX No. C.A. 3115,** THE CHEMICAL AGE 154, Fleet Street, London, E.C.4.

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FOUR stainless steel **MOTORISED AGITATORS,** direct coupled to 5 h.p. geared motors, 2-in. stainless steel shafts, 3-bladed propellers, 180 r.p.m. As new.

ONE stainless steel motorised **AGITATOR** by **MITCHELL,** 1 h.p. with adjustable shaft and two adjustable 2-bladed propellers. For vertical mounting with clamps.

TWO 200-gallon, open top, **STAINLESS STEEL TANKS,** 20's gauge.

TWO 150-gallon **STAINLESS STEEL** vessels, 2 ft. 6 in. diam. by 5 ft. deep, dished bottoms.

ONE sectional c.i. **TANK,** open top, 20 ft. by 10 ft. by 1 ft. 6 in. deep.

ONE 1500-gallon **JACKETED BOILING PAN,** welded construction from ¼ in. plate. Mounted on 4 feet.

THREE 100-gallon **JACKETED BOILING PANS,** dished bottom, bottom centre outlet. Mounted on 3 legs. New and unused.

ONE 400-gallon jacketed **DISINFECTOR** with quick release hinged doors.

NUMEROUS 40 to 60-gallon **JACKETED BOILING PANS,** working pressures from 40 to 100 lb. p.s.i.

"MORWARD" trough powder **MIXERS,** 16 to 100 cubic foot capacity.

We specialise in design and construction of all types of **MIXING VESSELS** and your enquiries are invited.

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Jacketed Vacuum/Pressure **AUTOCLAVE,** with aluminium inner pan and mixing gear, 8 in. diam. by 2 ft. 2 in. deep.

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"Werner" Twin Fin Blade Jacketed **TIPPING MIXERS,** 3 ft. by 2 ft. 6 in. by 2 ft. 6 in., 29 in. by 27 in. by 19 in., and 24 in. by 25 in. by 19 in.

"Weir" and "Serck" Unused Brass Tube **CONDENSERS** up to 100 sq. ft. tube area.

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ONE "LOCKER ROTEX" HORIZONTAL SCREEN, 48 in. by 20 in. Two screens ½ in. and ¼ in. Connections and spares. Mild steel and adjustable stand. 400/3/50 ½ h.p. enclosed motor. All new and unused. Cost £170; accept £125. Apply **BOX No. C.A. 3116,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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STORAGE VESSELS
Lancashire Boiler Type.
One 28' × 7' (6500 gals.)
One 26' × 8' (6000 gals.)
One 24' × 7' (5500 gals.)
Pneumatically Scaled, Painted, ready for use.
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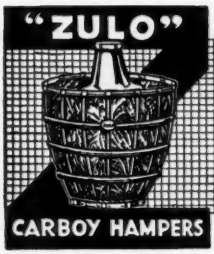

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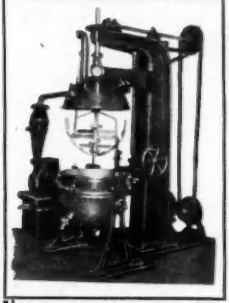

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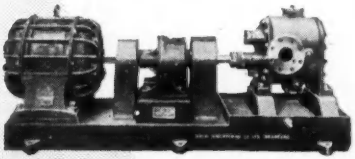

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